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FORTY-FIRST ANNUAL SESSION

Western Reserve University, Cleveland, Ohio

April 9 to 11, 1925

ABSTRACTS

PAPERS TO BE PRESENTED

1. *An embryological and experimental study of the blood-forming organs in anaemic mice.* S. B. DE ABERLE (introduced by C. H. Danforth), Stanford University Medical School.

Anaemia appears as a simple monohybrid mendelian trait among offspring of dominant white mice. An examination of several hundred anaemic mice shows that they conform with remarkable regularity to a definite type. Macroscopically, they can be recognized at the sixteenth day of gestation. A study of their blood at this age and at birth reveals a marked deficiency in hemoglobin, erythroplastids, and white cells. They invariably die within a few days after birth.

Histologically, there seems to be little difference between the two types except in the blood of the blood-forming organs. A comparison of livers, spleens, and bone-marrow from sixteen-day-old anaemic and normal fetuses and new-born discloses no fundamental differences in the parenchymal, but a marked difference in the structure and number of the blood cells.

Further evidence was obtained by grafting anaemic organs into normal individuals to determine whether or not these organs are capable of continuing

their existence with a supply of normal blood. A number of tissues, including liver, spleen, and bone-marrow of anaemics were transplanted to normal hosts and not only survived, but in some cases grew, beyond the time at which they would have died if not transplanted. These observations suggest that faulty blood-formation alone is responsible for the observed differences.

2. *Histological study of eye-defects in albino rats.* WILLIAM H. F. ADDISON, University of Pennsylvania.

From time to time, in the rat colony of The Wistar Institute, have appeared animals with defective eyes. The smaller size of the eye and the lens opacity are generally the first observed features. Histological examination shows considerable variation in the structure of these defective eyes, but in all there is some degree of degeneration and shrinkage of the lens. At an early stage the lens shows changes only in the central and posterior regions. Here it has an amorphous, distorted appearance, in which no normal structure is seen, while the greater part of the periphery shows the usual lens fibers, and the capsule normal, except at the posterior pole, where the hyaloid artery may be attached. Later stages show the entire lens substance degenerated and vacuolated. The outline of the lens is irregular and lobulated, with spheroidal masses attached to the outside of the original shrunken lens. Some sections show the lens substance divided into several parts, as a result of outflowing of the degenerated material through openings in the posterior capsule. Later, there is absorption of the lens substance and shrinkage, resulting in a small hard nodular mass. The anterior part of the capsule is thickened, and there are adhesions between it and the margin of the iris. The pupil is extremely minute, with remains of the tunica vasculosa lenticis. In marked microphthalmia, where the lens is usually much shrunken, the iris has a plane, not convex, surface, and the retina is thickened and folded.

3. *A suggested source of neurolemma (sheath) cells of the motor roots of the cranial nerves in the rat.* HOWARD B. ADELMANN, Department of Histology and Embryology, Cornell University, Ithaca.

In the trunk region of rat embryos the neural crest grows ventrally in close contact with the surface of the neural tube, reaching finally the level at which motor fibers emerge. When the latter appear, the ganglionic mass is spindle-shaped, its ventral extremity resting against the emerging motor-root fibers. Upon the basis of Harrison's convincing work on amphibia, one may conclude that the above-described contact furnishes a path of migration of neurolemma cells from the neural crest out along the motor root.

In the case of the trigeminal and acustico-facial ganglia, a spur of ganglionic cells grows ventrally from each ganglionic mass, closely apposed to the surface of the hindbrain. With the differentiation of the ganglion, the 'spur' becomes distinctly demarcated from the remainder of the ganglion. The fibers of the motor root emerge at the base of the ganglionic 'spur,' and, increasing in abundance, gradually obliterate it. The relation between these 'spurs' and the motor roots of the V and VII nerves is strikingly similar to the relation between the ganglionic crest and the motor roots in the trunk. It is suggested that they are the sources of neurolemma cells of the motor roots of these cranial nerves. No trace of such 'spurs' is found in connection with the anlagen of the IX and X ganglia which do not possess distinct motor roots.

4. *Further experiments with the hormone of the ovarian follicle.* EDGAR ALLEN, University of Missouri School of Medicine.

During the past year work with this substance has included the following:

1. Tests of extracts of human ovarian tissues removed at operation at different stages of the menstrual cycle and during early pregnancy, and two additional early chorionic vesicles (one abnormal). (Proc. Exp. Biol. and Med., February.)

2. Following positive results from subcutaneous injections of extracts of human placenta and early embryonic vesicles, the possibility of action of this stimulus through the uterine mucosa was tested. Injections of four to ten 'rat units' of hormone were made into the uterine cornua of previously ovariectomized rats and ligatures tied close to the cervix to retain the material. The uteri were not abnormally distended by the injections. Maximum oestrous reactions were indicated in the vaginal smears. Therefore, this growth stimulus may act from the lumen of the uterus of the rat.

3. In further studies of tissues of pregnancy we have tested material from the cow, pig, dog, cat, and rat. Extracts of amniotic fluid, placenta, chorions, embryos, and mucosal lining of uteri, and also, in the larger animals, corpora of pregnancy and the ovarian tissue remaining after excision of the corpora have been tested. To date the great majority of these results have been negative even when large amounts of tissue extract were highly concentrated.

5. *The method of repair in small wounds.* L. B. AREY, Northwestern University Medical School.

Tiny wounds can be induced in the gills and fins of fishes and in the gills of *Necturus* by artificially infecting these animals with appropriate larvae of fresh-water mussels. The ensuing process of encystment on the host furnishes opportunity for the study of wound-healing phenomena. The repair is rapid and the cyst complete in a few hours at summer temperatures. Cell division is not the responsible factor, but the defect is covered by a mass migration of neighboring tissue in which inert elements may be passively swept along. The participating cells number several thousand. In *Necturus* there is evidence that a later proliferation by mitosis in the depleted areas slowly compensates for those cells lost to the cyst wall by migration.

The question is raised as to whether this type of repair in small wounds is not common among vertebrates, including man.

6. *The morphology of the floor plate of *Amblystoma*.* R. C. BAKER (introduced by C. Judson Herrick), Ohio State University.

The floor-plate in early stages exhibits a definite structure—the neural keel. This is not present in the earliest medullary plate stage, but as soon as the neural-crest zones become conspicuous it appears as a ventromedian downgrowth of the neural plate extending from a point just posterior to the infundibular recess caudally, paralleling the extent of the neural plate. There is in the flat neural-plate stage a close relationship between the keel and a median longitudinal pigmented groove in the floor of the future canal, in respect to their anterior limits and future differentiation. The fully formed keel is largest toward its anterior extremity and throughout its whole extent a definite cell orientation is exhibited. The keel at this stage shows a heavily pigmented line which extends

dorsoventrally from the median longitudinal groove one-half the distance through the median plane of the keel. The succeeding differentiation consists of a separation along this pigmented line and is first characterized by the appearance of a well-defined lumen at the most ventral part of the line. This lumen increases in length dorsally until the median longitudinal groove is reached. As a result of this differentiation, the ventral part of the neural keel forms the floor-plate and the upper part of the keel contributes to the ventral medial portions of the basal plates.

7. *The 'dorsal flexure' of young human embryos.* G. W. BARTELMIZ, The University of Chicago and the Carnegie Laboratory of Embryology.

Many of the embryos of the first month show a concavity or kink in the dorsal contour. In some cases the condition is due to maceration or to the collapse of the yolk sac or to both. There is a question as to whether the development of the head and tail folds may raise the ends above the level of the middle of the embryo which is spread out on the yolk sac. There is evidence to show that if the embryonic area is originally so related to the yolk sac that the forward growth of the neural folds brings them beyond it, the elevation of the neural folds and the expansion of the pericardial cavity will tend merely to keep the dorsal contour straight. If, however, there is a pear-shaped and turgid yolk sac projecting beyond the embryo, then the development of the rostral end will tend to elevate it above the level of the rest and produce a gentle dorsal concavity, especially if similar conditions obtain caudally. This state of affairs could continue normally only up to the stage in which the yolk stalk begins to form.

8. *A quantitative study of the seminiferous tubules of cryptorchid testicles.* K. F. BASCOM and H. L. OSTERUD, Department of Anatomy, Medical College of Virginia.

This report continues work already done on the cryptorchid testicles of sheep and pigs. Total tubule length in normal pig testicles is calculated to be about 3200 meters, or exceptionally even 6200 meters. It varies in cryptorchid testicles of pigs between 180 meters and 5500 meters. Tubule length bears no constant relation to weight of testicle, since both tubule diameter and pattern of the cryptorchid testicle are variable. A similar condition prevails in the cryptorchid testicles of sheep. The variability in total weight, pattern, and tubule diameter of the cryptorchid testicles studied emphasizes the heterogeneity of this group and the difficulty of selecting a quantitatively typical specimen to represent the group.

The fact that cryptorchid testicles occur having a total tubule length equal to that of normal testicles indicates that influences inhibiting transverse growth of the tubules do not necessarily interfere with longitudinal growth. These observations, taken in conjunction with those made on normal immature and mature animals of the same species, indicate that probably growth in length may be independent of growth in diameter.

9. *The process of bone repair.* T. H. BAST, W. E. SULLIVAN, AND F. D. GEIST, Department of Anatomy, University of Wisconsin.

The conspicuous histologic manifestations occurring in mammalian bone subsequent to incomplete fracture, produced by a longitudinal saw-cut under aseptic conditions, may be summarized as follows:

1. The advent of fibroblasts at either end of the cut and their migration into the blood clot within the cut. Thickening of the fibrous periosteum and epithelioid periosteum (cambium layer) in the region of the cut.

2. The appearance of newly forming bone, derived from the cambium layer, between the cambium layer and the original bone.

3. The occurrence of cartilage is variable. It first appears on the fifth day after operation in the tissue on the external surface of the bone on either side of the cut. The cut surface of the fibrous periosteum expands out in contact with the cartilage. The cartilage and the fibrous periosteum are external to the newly forming bone and are not related to its formation. Cartilage is constantly absent in the cut.

4. Invasion of the cut and bridging of its extremities by new bone.

5. Absorption of new bone in the external and internal calluses by osteoclasia and by a process in which osteoclasts apparently play no part, which process we have termed 'bone necrosis.'

6. New bone essentially filling the cut. Excavation into the original bone along the cut with subsequent dove-tail union.

10. *The significance of interprocess ligaments.* O. V. BATSON, Department of Anatomy, University of Cincinnati.

There are a number of ligaments in the body which connect two processes on the same bone. An examination of these structures seems to indicate that they are really accessory tendons. These ligaments fall into two groups: those to which the muscle fibers attach more or less directly and those in which a bony process intervenes. Of the latter group the coraco-acromial ligament furnishes a typical example. This tendinous action is possible here because of the elasticity of living bone. This factor is commonly ignored because absent in the dry specimens. With the acromion fixed it is possible to demonstrate several millimeters' deviation of the coracoid process by pulling on the tendon of the pectoralis minor or the combined tendon of the coracobrachialis and the short head of the biceps. Other interprocess ligaments are similarly analyzed.

- 11 a. *Materials and methods for the study of the heart, liver, spleen, and kidneys, with their average weight, and the relation of weight to sex and race.* R. BENNETT BEAN, University of Virginia.

Records of 4871 persons were available for organ weights from the first 5000 necropsies at the Johns Hopkins Hospital, the first 6000 at the Charity Hospital, New Orleans, the first 2000 at the Touro Infirmary, New Orleans, and the first 1000 at the University of Virginia Hospital. Of these, 3508 were male and 1363 were female.

Each organ was eliminated which had any macroscopic pathologic lesion. Each record was then studied and the weight tabulated in relation to age, race, sex, stature, disease, and condition of nourishment. The percentage of normal to abnormal organs was for the male heart 33.2, liver 30.5, kidneys 18.3, spleen 28.5; for the female heart 52.1, liver 37.3, kidneys 26.3, and spleen 40.6.

The organs have an average weight between twenty and sixty years for the male heart 298.1 grams, liver 1644.3, kidneys 344.3, spleen white male 141.3, colored male 122.1; for the female heart 252.4 grams, liver 1411.3, kidneys 312.0, and spleen white female 115.3, colored female 97.2. There is no significant racial difference in the heart, liver, or kidneys.

11b. A four-dimensional table for expressing the arrays of four factors. R. BENNETT BEAN, University of Virginia.

This table was devised to illustrate the relation of organ weight to age, stature, and condition of nourishment, but it has already served for other purposes.

It is a simple table in which the age groups are placed on one side and the organ weights arrayed opposite each age group; the stature groups are placed below and the states of nourishment are arrayed opposite each stature group. This enables the array of organ weight to be seen at a glance in any age and stature group in the fat, well-nourished, thin, or emaciated. Any group may be compared with any other group or with a similar group in another sex or race.

Take the group at age forty to forty-nine, stature 160 to 164 cm., of the well-nourished males, for the liver weight, and compare them with a similar group of females. We find for the males one liver at 2125 grams, six at 1875, three at 1625, three at 1325, and one at 1125, and for the females three at 1625 grams, two at 1375, and four at 1125.

Those with large organs died of acute diseases and those with small organs died of chronic diseases.

11c. The weights of the heart, liver, spleen, and kidneys in relation to age, stature, and condition of nourishment. R. BENNETT BEAN, University of Virginia.

Age. The heart increases in size between twenty and eighty years and decreases thereafter. The female heart increases about 5 per cent more than the male.

The liver decreases in size continuously from twenty years onward, as also does the spleen. The decrease is proportional to the increase in the heart, about 5 per cent from twenty to fifty years, 10 per cent from fifty to eighty years, more thereafter, greater in the female than in the male, and greater in the spleen than in the liver.

The kidneys remain the same size between twenty and fifty years, but decrease in size thereafter.

Stature. The heart of the well-nourished, thin, and emaciated is about 20 per cent larger at 180 cm. stature than at 160, before forty years, but afterward there is almost no difference.

The liver weight is about 15 per cent larger, but the kidney weight varies little.

Nourishment. The heart is about 10 per cent larger in the well-nourished than in the emaciated, the stature and age being the same, and the liver and kidneys are about 15 per cent larger.

The liver of the well-nourished is larger in the young than the old, regardless of stature, but this is not true of the thin or emaciated. The kidneys are similar to the liver in this, but the heart is not.

There are too few spleens.

11 d. *The relation of the heart, liver, spleen, and kidney weight to certain diseases.*

R. BENNETT BEAN AND EUGENE OSMUN BARR, University of Virginia.

The weight of the normal heart, liver, spleen, and kidneys is large in those who died of acute diseases, and small in those who died of chronic, when the race, sex, age, stature, and condition of nourishment are the same. This does not seem to be the result of hypertrophy in acute diseases, because the time of illness is too short. For instance, in acute lobar pneumonia, which kills in a few days, the organs are larger than in any other disease. Nor is it the result of atrophy in chronic diseases because the liver and spleen in tuberculosis, for instance, seem to be hypertrophied.

Acute diseases include chiefly accidents, operations, apoplexy, acute infections, and lobar pneumonia. Chronic diseases include chiefly carcinoma, tuberculosis, syphilis, abscesses, and chronic infections.

Syphilis is an exception. Here the organs are large.

The organs have about the same weight, whether the patients were well-nourished, thin, or emaciated, in acute, and the same is true in chronic diseases.

The organs used in this study had no macroscopic pathologic lesion, therefore the inference seems to be that those persons with large organs are more susceptible to acute diseases than those with small organs, and vice versa. More work is needed to confirm this hypothesis.

11 e. *Preliminary notes on a study of mongoloid dwarfs.* ROBERT BENNETT BEAN AND FREDERICK HENRY WILKE, University of Virginia.

The cranial sutures of mongoloid dwarfs between five and thirty-five years are wider open than in normal children, and the metopic suture is present more frequently.

When the measurements of the mongoloid dwarf boys are compared with Filipino hypomorph boys and American white hypermorph boys, it is found that the Filipinos are in between the other two, and the same is true of the girls. There is practically no overlapping of the extremes between the mongoloid boys and the hypermorph boys. This applies particularly to stature, sitting height, and leg length.

The difference is still greater in relation of leg length to sitting height, and of sitting height to stature.

The length, breadth, and height of the head and the length and breadth of the foot and hand, with their indices, show similar differences.

The resemblances of the mongoloid dwarf to the Filipino hypomorph indicate that the former is the hypomorph of the whites in the same way that the Filipino, or Malay, hypomorph is of the yellow-browns, and the negrito and negrito hypomorph of the blacks.

The ear of the mongoloid dwarf has an irregular, overturned, and often curled or twisted helix so often found among the blacks.

However, the mongoloid dwarf resembles the hypermorph of the whites in the narrow face, nose, and ear.

11 f. *A preliminary survey of more than eleven hundred abnormal children.*

R. BENNETT BEAN, University of Virginia.

This survey was made at the institutions in Vineland, Woodbine, and New Lisbon, New Jersey.

More extremes of anatomical form were found than in the average population. That is, the extreme hypermorph, who is small, slender, with long head, face, nose, and ears, arms, legs, hands, and feet, and the extreme hypomorph, like the mongoloid dwarf, who is short, squat, with rounded head, short face, nose, ears, arms, legs, hands, and feet.

The proportion of the extreme hypomorphs decreases with age as that of the extreme hypermorphs increases. For instance, among the boys at the Training School in Vineland, 50 per cent were extreme hypomorphs and 20 per cent extreme hypermorphs at six to ten years of age, 9 and 43 at eleven to fifteen, 9 and 49 at sixteen to twenty, 6 and 61 at twenty-one to twenty-five, 0 and 61 at twenty-six to forty, and 22 and 33 at forty years and over.

It may be noteworthy that about 100 of the 1100 children examined were mongoloid dwarfs.

There were a great many abnormal and bizarre forms, especially among the low grades.

12. *Studies on traumatic muscle injury.* G. O. BERG and T. H. BAST, Department of Anatomy, University of Wisconsin.

The object of this study is to ascertain the morphological changes which follow traumatic injuries of the type which in slang vernacular and especially among athletes are known as 'Charley horses.' The injuries were produced with the aid of a rawhide mallet on the thigh muscles of dogs under the influence of morphine.

A gross examination revealed the fact that the muscles were swollen. Hemorrhages were constant in the connective-tissue fascia and in some cases in the endomysium.

The earliest microscopical pictures are typical of a sterile muscle inflammation. Oedema either with or without hemorrhage is constant. The most characteristic pathology is in the muscle substance. At first the muscle fibers lose their cross striations. The fibrils swell and coalesce. In more severe cases, however, this process of destruction is continued by nuclear necrosis and by the entrance of large numbers of mononuclear leukocytes into the muscle substance which they destroy. There is evidence that the blood-vessel endothelium proliferates these mononuclear leukocytes. Polymorphonuclear leukocytes are also present in large numbers. Fibroblasts are also undergoing active proliferation. In the cases thus far studied the healthy ends of the injured muscle fibers proliferate long rows of muscle nuclei which migrate into the destroyed muscle area and there develop new fibers.

13. *Trends of variation in the gall-bladder characteristic of different mammalian species.* EDWARD A. BOYDEN, Harvard Medical School.

Various types of cleft and accessory gall bladders occur in domestic mammals and man. One of these, the ductular bladder, recently described by the author in the domestic cat, has since been found in sheep, cattle, and possibly man. But these and the more commonly bifurcated types vary in pattern and frequency according to the species. Thus the human gall bladder is remarkably conservative, only one sort of variation having been adequately reported, namely, complete duplication, each vesicle having its own cystic duct (the two ducts uniting before reaching the hepatic duct or traveling separately to the choled-

ochus); in cats two-thirds of the variations consist of a bifurcation of the fundus—a type not yet reported in man; whereas, in cattle variations are about equally divided between deeply cleft gall bladders and supernumerary vesicles associated with cyst-hepatic ducts. Although pancreatic bladders, were found in the cat only, it is suggestive that three cases of aberrant pancreatic lobes, reaching from the gall bladder to the ductus pancreaticus, appeared in 2560 sheep. In total number of variations the cat exceeds all others, having an average of 1 anomaly to every 8th animal (in 2568 specimens); as compared with 1 to every 33rd (in 1911 calves); 1 to every 85th (in 2560 sheep); and 1 to every 445th (in 1335 pigs); in man only a few cases were reported in 9000 cadavers.

14. *Influence of nerves on the position of the coeliac artery in chick.* JOHN LEWIS BREMER, Harvard Medical School.

Recently I noted the asymmetrical position of the coeliac artery in birds, and came to the conclusion, on morphological grounds, that this aortic branch, from its early median ventral origin, had been moved around the aortic wall by the traction of the fibers of the right sympathetic nerves, which enmeshed the vessel and retracted before the nerves of the left side had reached the midline. The asymmetry of the nerves was traced to the twist of the neck region accompanying the well-known head twist. To test this conclusion, experiments designed to equalize the nerves of the two sides have been continued.

Chicks of five days, with median coeliac artery, encircled by nerves from both sides as in mammals, have been obtained after early cautery of the right neural crest to retard the growth of the right nerves.

The same result appeared after the reduction of the early asymmetry by either of two methods: 1) that used formerly of turning the head over on to its other side, but with the addition of a weight to prevent its return to normal; 2) the shortening of the left side of the body, dorsoventrally, by cautery of the somites (at about fifty hours), so that the left and right nerves would have an equal distance to grow to reach the coeliac artery.

15. *Development of the nasal cavity in the striped ground-squirrel (Spermophilus citellus tridecemlineatus).* B. I. BURNS (introduced by H. J. Prentiss), Department of Anatomy, University of Iowa.

The primitive nasal cavity grows dorsally from the olfactory placode, paralleling the roof of the primitive buccal cavity. Before reaching the limit of its dorsal growth, the cavity extends toward the primitive buccal cavity from which it is separated for a short time by the bucconasal membrane. The rupture of this membrane forms the primitive posterior naris. At about the time of the rupture of the bucconasal membrane, the anterior naris becomes closed by an epithelial plug which persists until the primitive posterior naris is obliterated by the formation of the definitive palate. The floor of the primitive nasal cavity posterior to the primitive posterior naris undergoes a gradual recession following the rupture of the bucconasal membrane. Coincident with the above changes, the palate processes appear and grow medially. These processes fuse with each other in the midline and with the nasal septum above, separating the primitive buccal and nasal cavities and completing the separation of the nasal cavities below the primitive nasal septum. Anteriorly, the palate processes fuse with the anterior

margin of the primitive posterior naris (premaxilla). The fusion in this region is complete, so far as the soft tissues are concerned, but incomplete in the bone, forming the foramina of Stenson and Scarpa.

16. *The tortuous splenic artery.* A. GERSON CARMEL (introduced by O. V. Batson), Department of Anatomy, University of Cincinnati.

It is commonly stated that the splenic artery is remarkable for its tortuosity.

In a small series of cadavers (thirty) it was found that in only one-fifth of the specimens was the splenic artery notably tortuous, in three-fifths it was practically straight, and in the remaining one-fifth it exhibited but slight curvatures.

The straight arteries had an average diameter of 0.6 cm. to 0.7 cm., whereas the tortuous ones had an average diameter of 1.0 cm., and in the walls of the latter fatty deposits typical of atherosclerosis were found; the straight vessels did not show such changes. The tortuous arteries also showed thicker walls. The accompanying veins in all cases were straight.

From this series it appears that a straight course is normal for the splenic artery and that a tortuous splenic artery is in reality a diseased one.

17. *A gland-like organ in the brain.* H. H. CHARLTON, University of Missouri School of Medicine and Central Institute for Brain Research, Amsterdam, Holland.

Ariëns Kappers describes briefly a thickened ependyma lining a portion of the wall of the ventral thalamus, more prominent in the reptiles, but present also in fishes and birds, which he considers to be a glandular organ.

In the teleost *Motella mustela* the organ is very striking and not only borders a part of the ventral thalamus, but is continued to line a considerable portion of the median end of the lateral recess and is probably continued postero-inferiorly to line the mamillary recess as well. In the roof of the lateral recess the organ has the appearance of simple tubular glands numbering from three to five on each side. In formalin-fixed specimens the cell boundaries are somewhat obscure, but the nuclei indicate that the modified ependyma consists here of more than a single layer of cells. The peripheral cells are without cilia and the organ as a whole is extremely well provided with blood vessels. As mentioned by Kappers, the ventricle opposite to the gland-like ependyma usually contains an albumin-like substance.

The organ is present in varying degrees in practically every teleost examined.

It is interesting that the tractus griseo-tuberis, an unmodulated tract described by Holmgren, is coextensive with the gland-like area and may bear some direct relation to it.

18. *A study of the fate of extruded erythrocytes.* E. R. CLARK and ELEANOR LINTON CLARK, Medical Department, University of Georgia.

Minute hemorrhages were produced experimentally in the tail fin of *Hyla* larvae, and their removal studied by direct observation of the living. The extravasated erythrocytes were taken up from the tissue spaces in two ways: either by lymphatic capillaries (in a manner described by E. R. Clark in 1909) or by pigmented wandering cells, which appear to be the equivalent, in amphibia, of the clasmatoocytes of mammals.

The lymphatic capillaries play the major part of the removal, if the extruded cells are within a distance of $76\ \mu$ from the lymphatic. Within this distance the erythrocytes exercise a specific attraction on the endothelium which sends out sprouts which draw the cells into their interior.

If the erythrocytes are farther away from the lymphatic capillary than $76\ \mu$, and if they have remained twelve hours or more in the tissue space, they are gradually phagocytized by the pigmented wandering cells.

Within the latter the erythrocytes soon go to pieces and are apparently digested, while those which are taken up by the lymphatics are returned to the blood stream intact.

19. *Notes on the history of anatomy in the earlier Middle Ages, II.* George W. CORNER, University of Rochester.

At the last meeting the author discussed the sources and probable dates of certain anatomical treatises of the twelfth century, derived from Arabic origins through the translations of Constantinus Africanus. A century afterward, a second wave of translation from the Arabic gave Aristotle and the later Arabs to the Western world; from this period dates the so-called "*Anatomia Ricardi Anglici*," known from a corrupt fifteenth-century manuscript at Berlin and also from the earlier printed editions of Galen, in which it appears as "*Anatomia vivorum*."

The author's attempt at critical study of "*Anatomia Ricardi Anglici*" has uncovered a good deal of exact information as to its sources in mediaeval literature, indicating a date of composition in the first half of the thirteenth century, not many decades from 1225. Most interesting of all, one of the French provincial libraries has yielded a hitherto unrecognized manuscript of this work in a thirteenth-century hand.

The text itself is a striking example of scholastic method, being hardly more than a cento from the earliest Latin versions of Aristotle and the Arabs, couched in elaborated scholastic style, and without any independent observation. Although based upon much richer sources than the Salernitan anatomies of the previous century, it exhibits in contrast with them a decadence due to continued theorizing without observational test—a lesson not without modern applicability.

20. *The hypophysis of anencephalic fetuses.* W. P. COVELL (introduced by A. T. Rasmussen), Department of Anatomy, Medical School, University of Minnesota.

A hypophysis was present in all of the thirty-two anencephalic fetuses examined. The fetuses ranged in age from the fifth month to full term. Serial sections were made from twenty-five of them. Eight were used for volumetric study. The hypophysis lies on a flattened sella turcica. The glandular portion consists of two lateral and one central mass. Pars nervosa was present in 20 per cent of the cases. Pars intermedia may be present without the pars nervosa. An infundibulum was lacking in all instances.

The total weight of the hypophysis was generally below that of the normal for a fetus of corresponding age. The anterior lobe is overweight, due to the dilatation of the sinuses with blood and increased amount of trabeculae.

Pars intermedia is about normal in amount. In some instances it could not be made out, due to the excessive amount of blood. Pars nervosa is never present in full amount.

Pars anterior represents 92 to 98 per cent of the total weight as compared to 73 to 84 per cent for the normal hypophysis. The trabeculae 1 to 4 per cent as compared with 0.8 per cent for the normal. Pars intermedia is about 3 per cent of the total weight. Pars nervosa when present is 1.5 to 5 per cent of the total weight as compared to 14 to 24 per cent for the normal fetal hypophysis.

21. *Postnatal changes in vascularity in the cerebral cortex of the albino rat.*
E. HORNE CRAIGIE, Department of Biology, University of Toronto.

Measurements of the total length of the capillaries in a unit volume of tissue have been made in five different areas of the cerebral cortex at the ages: birth, 10 days, 21 days, 90 days, 140 days, 390 days.

The vascular supply is much poorer at birth than later in life and increases slowly during the first ten days, in which period the differentiation of the cortical laminae is completed.

Between the tenth and the twenty-first days, during which time the thickness of the cortex continues to increase, there is a rapid rise in the vascularity; while after the twenty-one-day stage, when the cortex is fully differentiated and functional, but undergoes a two-dimensional growth, the capillary supply becomes richer very slowly. In the occipital and parietal areas the results indicate a continual slight increase up to 390 days, while in the insular and temporal regions the measurements show a drop after ninety days, and in the praecentral area remain practically stationary from that period.

The differentiation in the vascularity of the different areas and of the layers in each area is less marked up to ten days than it is from twenty-one days on.

22. *Adiposity and doubling as constitutional traits in the mouse.* C. H. DANFORTH, Stanford University Medical School.

Constitution may be regarded as an attribute of the organism resulting from the interaction of hereditary and environmental factors. On the side of heredity the central problem is to determine to what extent the constitution is regulated by separately heritable unit factors and to what extent, if at all, by some generalized quality of the germ-plasm. The analysis of this question is rather difficult with human material; but the mouse, one of the most rapidly breeding mammals, proves especially favorable for study of the problem. A condition of adiposity in which individuals become two or three times as heavy as ordinary mice is a simple monohybrid trait. In all except albinos of this strain the presence of this tendency is revealed by the hair color before the end of the first week of life, and the future relative size of litter mates can be predicted at that time. Doubling, and also the suppression of parts, with concomitant malformations in the digestive, urinary, and reproductive systems, has been observed during the past eighteen months and is shown by breeding experiments to be due to hereditary causes. The genetic analysis is incomplete, but sufficient to link up several conditions that have been regarded as distinct entities. The available evidence makes it probable that these manifestations are end products of discrete factors rather than diffuse qualities of the germ-plasm.

23. *The primary divisions of the myocardium in the human embryo.* CARL L. DAVIS, Department of Anatomy, University of Maryland, Baltimore.

This study is based on a series of ten human embryos between the stages of two and twenty paired somites. Both myocardium and endocardium arise from bilaterally symmetrical primordia (five somites). The retrocardiac plates are divided into bulbar, ventricular, and atrial segments by bulboventricular and atrioventricular sulci. At this stage the bulbar segments have fused; the ventricular portions are separated by a middle cardiac plate; the atria are widely separated. The middle cardiac plate persists through the seven-somite stage; the atria meet in the midline at the nine-somite stage, but retain their paired nature throughout subsequent stages. At the seven-somite stage the relatively enormous aortic bulb is separated from the bulbus cordis by an interbulbar sulcus. It progressively diminishes in size as the inclosed endothelial plexus is converted into aortic arches and aortic bulb. The left bulboventricular sulcus deepens, while the right one decreases in depth, to disappear at the stage of eleven to twelve somites, thus forming the bulboventricular loop. The right atrioventricular sulcus deepens, causing the atrioventricular canal to shift to the left, so as finally to connect the ventricle with the left atrium alone (eleven to twelve somites). The heart is now at the so-called 'S'-shape stage and the following segments are recognizable: aortic bulb, bulbus cordis, ventricle, and paired atria. No trace of a ventral mesocardium is seen at any time. The dorsal mesocardium disappears between the eleven- to twelve-somite and the twenty-somite stages.

24. *Microchemical studies on the formation of hydrochloric acid by the stomach.* ALDEN B. DAWSON, Loyola University School of Medicine, and A. C. IVY, Hull Physiological Laboratory, University of Chicago.

Pawlow pouch dogs were used. The ready access which is had in such a preparation to a normally secreting gastric mucosa eliminates several factors which are sources of error in the experiments of other authors. Neutral red proved to be the most satisfactory indicator of acidity. Cyanamin bichloride is much less valuable as an indicator, since it requires a P_{H3} to produce a decided color reaction. Balanced solutions of sodium ferrocyanide and ammonium ferric citrate were also employed. Indicators were applied in three ways: 1) Small portions of the active mucosa were clipped, teased, and immersed in the solution. 2) The indicator was injected intravenously. 3) The pouch was filled with the solution. Evidence has been accumulated which shows that, immediately after removal of tissue from the pouch, the crypts, lumina, and even the canaliculi give an acid reaction to neutral red. In a short time, however, the reaction shifts to neutral, and later to alkaline in all parts except the upper portion of the lumen and the crypt. The active parietal cell, with intravenous injection of neutral red, gives a slight acid reaction, possibly due to the presence of an acid phosphate. Our findings appear to substantiate Maly's theory and to indicate that Hammett's criticism of the work of Harvey and Bensley was well founded.

25. *Distribution of vitamine X in natural foods.* HERBERT M. EVANS and GEORGE O. BURR, Department of Anatomy, University of California.

Vitamine X is present, but never highly concentrated in a great variety of animal tissues, musculature, subcutaneous fat, and viscera, included in the latter being pancreas, spleen, liver, heart, hypophysis, and placenta). It is present in the tissues of rats reared upon natural foods, but absent in those reared upon the 'pure'-food regime. It is low, but present, in milk-fat and almost totally absent in cod-liver oil. It is present in egg yolk.

In vegetable tissues—X is low, or absent, in the tuber (potato), but abundant in leaves and can be demonstrated to be unhurt after careful desiccation of such leaves (lettuce, alfalfa, pea, bryophyllum, tea). It is present in some fruits (banana) and particularly abundant in some seeds (wheat, corn, oats, cotton, lettuce, alfalfa).

Since X is fat-soluble (Evans and Bishop, *Anatomical Record*, April, 1924), we have studied vegetable oils. Most of them contain the vitamine, but few in high concentration. Crisco, crude cottonseed oil, cocoanut, walnut, peanut, and flaxseed oil can all be fed daily in quantities five times the required minimum of wheat-germ oil without restoring fertility. Yet butter, walnut oil, and Crisco have been proved to do this immediately when fed at high levels.

The vitamine is thus seen to have a wide distribution if we disregard percentage abundance. In no other instances have we been able to encounter it in as concentrated form as in the ether extract of wheat embryo and desiccated lettuce leaves.

26. *Characteristics of the anterior hypophyseal hormones.* HERBERT M. EVANS and MIRIAM E. SIMPSON, Department of Anatomy, University of California.

We have employed as test objects litter-mate rat sisters from 90 to 150 days of age. The best nutritional regime is instituted so that maximum growth and 'plateauing' is attained before treatment begins. The resumption of rapid growth and cessation of ovulation are reliable and characteristic indications of the presence of the growth and sex hormones, respectively. Immediate steps in the purification of the hormones were deemed less important than the preparation of protein-free, or largely protein-free, and bacteria-free solutions. We have succeeded in securing active, Berkefelded, clear solutions from which much of the protein has been removed and which are easily absorbed. Relatively complete precipitation of the proteins by heat or by heat and acid always results in destruction of the hormones, which endure the precipitation of much protein in the cold by weak acid. Loss of protein and preservation of hormone strength is best accomplished by neutralization of alkaline extracts. The hormones pass the Berkefeld filter when in alkaline medium and when the pores have been cleaned by the oxalic and permanganate method. They can be concentrated in vacuo. While the sex and growth hormones are usually preserved or destroyed together by various procedures, some evidence of their separation was again furnished by the relative preservation of the former effect and loss of the latter when anterior-lobe fluid is treated with varying concentrations of ethyl alcohol.

27. *The histology of the blood of Perophora viridis.* W. C. GEORGE, University of North Carolina.

The blood of *Perophora* contains six different types of cells: 1) Green cells, containing green globules of a fatty nature embedded in clear cytoplasm. The nucleus is excentric in position and is surrounded by the green globules except on the side nearest the surface of the cell. 2) Orange cells, which are few in number and smaller than the green cells, contain orange-colored globules. 3) Colorless morula cells. These contain a variable number of colorless bodies, apparently vesicles distended with fluid, embedded in the cytoplasm. The nucleus is excentric. 4) Granular amoeboid cells. These have the endoplasm filled with coarse granules some of which are fatty. 5) Compartmental amoeboid cells consist of a region containing the nucleus and of several angular vacuoles separated from one another by thin cytoplasmic partitions. These vacuoles contain fatty granules exhibiting active brownian movement. 6) Signet-ring type of cell. This cell has a thin shell of cytoplasm, thickened at one point by the presence of the nucleus, surrounding a large vacuole. The vacuole sometimes contains dancing granules and sometimes an inactive granular mass.

28. *An appeal for classification and conservation of human scapulae.* WILLIAM WASHINGTON GRAVES, Saint Louis, Missouri.

Classification into convex, straight, and concave types brought scapulae into definite relation to various problems, particularly human ontogenesis, heredity, longevity, morbidity, and adaptability. Classification discloses the range in type variation common to the scapulae of mankind. Scapular types are primal in origin, are transmitted from parents to offspring with unusual constancy, and are found in varying percentages from the tenth fetal week onward, regardless of race, stock, social level, and various environmental influences. A particular type is only one feature of individual inheritance. A singular finding is the age incidence of scapular types, i.e., the convex increases, while the straight and concave decrease in frequency of occurrence in groups of individuals representing successive age periods from birth to old age. Investigations, including observations on the living in successive age periods from birth onward, show that one type is not changed into another; hence greatest selection occurs in possessors of straight and concave types. Scapular classification supplies new and accessible approaches to the enduring problems of the constitution of individuals, stocks, and races; hence this appeal for classification and conservation of scapulae and, when possible, all skeletal material. Scapular types are logical bases for correlating human variations (similarities and differences). Accumulation of data is desirable on age, sex, race, stock, occupation, cause of death, scapular types, and types of face, skull, nose, ears, sternum, chest, and other inherited variations.

29. *A young human ovum in situ.* J. P. GREENHILL (introduced by R. R. Bensley), Department of Anatomy, The University of Chicago.

The ovum was obtained from an intact aborted decidual cast. Including the capsularis, it measured $9.4 \times 7.3 \times 3$ mm. in formol. It belongs to group II of Streeter. The decidual reaction is more marked in the stroma than the glands. Both superficial vessels and glands near the implantation site show signs

of pressure from the growing ovum, but the outstanding feature is the evidence of erosion in the transitional zone, where maternal and foetal tissues are in intimate contact. Two generations of trophoblast can be distinguished (Grosser): There is an outer shell of cyto- and plasmodi-trophoblast, the latter both in the intervillous space and invading the decidua. The second generation is the trophoblast of the definitive villi, some of which show indications of branching and vascular anlagen. They show a chorion frondosum and laeve. An operculum deciduale (Teacher) can be recognized in the decidua capsularis; it is in contact with syncytium of the chorion plate. There are detached masses of plasmodium in the deeper vessels of the decidua.

30. *Structure and normal contents of the ductus and saccus endolymphaticus in the guinea-pig.* STACY R. GUILD, Department of Anatomy, University of Michigan.

Modifications of the terms ductus and saccus endolymphaticus, as usually defined, will be suggested on the basis of histologic structure. The narrow part of this membranous formation usually extends slightly beyond the middle of the bony aqueduct and, together with the adjacent expanding portion, has squamous epithelium with peculiar basal processes and occasional small crypts. Just distalward from the expanding region a somewhat gradual thickening occurs between this epithelium averaging 3.7μ in thickness (sacculus in same material averages 2.6μ) and one of columnar type averaging 18.6μ , which extends beyond the bony aqueduct as far as the anterior margin of the transverse sinus, over which the epithelium is again lower, averaging 4.4μ . The region characterized by columnar epithelium has 'patches' of squamous epithelium, small epithelial processes into the lumen, and larger vascularized processes and crypts. Small vessels are much more numerous around this columnar epithelial region than about other parts.

The lumen of the saccus endolymphaticus normally contains numerous free cells, most of which appear to be disintegrating desquamated epithelial cells; it also contains considerable material which precipitates upon fixation and stains very heavily with iron-hematoxylin.

The experimental evidence presented last year of circulation of endolymph is supported by the special structure of the part of the wall concerned and by the fact of the normal contents found in the lumen.

31. *Studies on the vagina during the oestrous cycle in the rat and guinea-pig.* ALAN F. GUTTMACHER, University of Rochester.

A. A study of the vaginal smear of the rat by the supravital staining technique: A slight amount of vaginal secretion was withdrawn and a thin film made on a slide previously stained with neutral red and Janus green. The preparation was rimmed with vaselin and studied in a warm box. The cycle of the dead and living leucocyte was observed and will be reported in detail. It was also found that the epithelial cells varied markedly in their ability to take up the dyes at different stages of the oestrous cycle.

B. Observations on the vaginal closure membrane of the guinea-pig: For two years we have utilized solely the condition of this membrane in following the oestrous cycles of a large colony of guinea-pigs. After some practice we have found this method to be as reliable as the vaginal smears and very much more

rapid. The number of days in each cycle in which the vagina remains open was computed. The age at which the membrane initially opens and the behavior of the membrane during pregnancy and after spaying were also observed.

32. Recent observations on the structure and function of the gall bladder.

BELA HALPERT (introduced by L. H. Weed), Johns Hopkins Medical School.

The gall bladder develops as an outpouching of the duodenum, growing out caudally to and simultaneously with the hepatic diverticulum. The entodermal portion forms the epithelium and the mesoderm the other two layers which are already differentiated in an 80 mm. human embryo.

Histological and embryological studies, carried out recently, have led to the differentiation of the following layers: 1) Epithelium, high cylindrical, mucosa itself unevenly folded. The pockets in this layer, described by Aschoff as 'Luschka crypts,' are not glands; glands occur only near the cystic duct. In distended gall bladders I have not found crypts. 2) Subepithelial layer, thin and drained by numerous blood and lymph capillaries. 3) Muscularis, consisting of irregularly arranged inner longitudinal and outer circular muscle bundles, separated by the connective tissue accompanying the penetrating vessels. In a 25-mm. human embryo, the gall-bladder musculature is not developed, though that of the intestines is differentiated. 4) Perimuscular layer, attached to liver on one surface and covered by peritoneum on the other.

The function of reabsorption of bile is attributed to the gall bladder. Histological evidence of this resorptive function is gained by finding of anisotropic lipoids in the mucous membrane. In addition to returning important bile constituents to the blood stream, the gall bladder regulates the pressure in the ducts when the sphincter papillae is closed.

33. The absorption of certain substances from the air sac of the incubating hen's egg. E. B. HANAN (introduced by Wayne J. Atwell), University of Buffalo.

Trypan blue, 1 per cent aqueous solution, injected into the air sac of the egg as early as the fifth day of incubation, is readily absorbed by the living embryo without toxic effects; vitally stained and healthy chicks having been hatched nine days after the last injection. Histological examination of the urogenital organs of one of these chicks three weeks after hatching shows the trypan blue in the cells of what appear to be the remains of the mesonephros; the metanephros, adrenal, and testis containing no trace of the dye.

Potassium ferrocyanide (Weed's method) given by the same route appears to be excreted by the mesonephros and is slightly more toxic than trypan blue. Glucose injected in small amounts is readily absorbed, producing hyperglycemia of several hours' duration. In keeping with its influence on the adult, insulin produces a hypoglycemia. The lowest blood sugar, from a single injection, being attained in about two hours, with a return to normal in four or five hours.

The appearance of the glucose in the blood stream, the characteristic effect of insulin, together with the fact that dead embryos subjected to the absorption of trypan blue for the same length of time as the living do not stain, indicates that the respiratory vascular network and lymphatics of the chorio-allantois are probably the chief factors in the absorption.

34. *The rôle of the neural-crest cells in the formation of the meninges in Amblystoma.* S. C. HARVEY and H. S. BURR, Departments of Surgery and Anatomy, Yale University.

An experimental study of wound healing in the meninges by the senior author showed differences in the reactions of the dura and leptomeninx to injury. When the dura is traumatized without injury to the leptomeninx, healing occurs without adhesion between them. When, on the other hand, the leptomeninx is injured without damage to the dura, the two meninges contribute to the reparative process with resulting adhesions. These divergent reactions point to an histogenetic difference.

Harrison has shown that the protective sheaths of the peripheral nerves are derived from neural-crest cells and Stone has shown that some of the supporting structures in the head region also are similar in origin. This suggested to the senior author the possibility of a different origin for the dura and leptomeninx.

Careful study of series of pig and chick embryos gave some indication of a difference in origin. The application of experimental methods seemed to offer the most certain evidence, since in *Amblystoma* embryos it is possible to transplant sections of neural tube with and without normal crest cells. Two series of experiments were performed.

In the first series a quadrilateral block of tissue containing the eye, the sub-jacent neural tube, and the environing neural crest and mesenchymal tissue was removed from an embryo of *Amblystoma* and transplanted to the side of the body. In the second series the cerebral hemisphere was exposed at a period when the majority of neural-crest cells had reached their ultimate destination and such loose cells as remained on the surface of the hemisphere removed. The hemisphere itself was then excised and transplanted to another embryo. The results in the two series were widely divergent. In the first series the transplants showed a section of neural tube completely surrounded by normal meninges consisting of dura and leptomeninx. The second series showed a section of neural tube devoid of leptomeninx and incompletely surrounded by dura. This would seem to indicate that the leptomeninx is derived from cells of neural-crest origin, while the dura develops through a process of condensation of mesenchyme.

35. *The innervation of palatal taste buds of Amblystoma.* C. JUDSON HERRICK, The University of Chicago.

The palatal taste buds are encircled by dense spirals of rather coarse smooth nerve fibers derived from the palatal plexus. The cell bodies from which these fibers arise are not demonstrated in these preparations. Some speculations are added regarding the functions of these circumgemmal fibers and their possible rôle in reinforcing the sensory excitation of the intragemmal fibers or activation of the sense organs and the part played by bioelectric factors in sensory excitation in general.

36. *Early stages in the development of the pig embryo.* C. H. HEUSER and G. L. STEETER, Carnegie Embryological Laboratory, Baltimore, Maryland.

There will be given in this paper an account of the tubal and uterine egg of the pig throughout the first three weeks of development. Photographs will be shown

demonstrating the formation of the segmentation cavity, the inner cell mass, the early bilaminar blastocyst, and the subsequent formation of mesoderm. Later stages will also be shown in which the differentiation of the embryonic disc can be followed throughout the period of somite formation.

37. *The jugular lymph sac in the albino mouse.* GEORGE M. HIGGINS, Mayo Foundation, University of Minnesota.

Embryological and morphological studies have been made upon the jugular lymph sac in the albino mouse. Transverse and longitudinal serial sections of mice embryos having a C-R measurement of 5 mm., 7 mm., 8 mm., 10 mm., 12 mm., and 15 mm. have been carefully examined and reconstructions in wax have been made of those stages most instructive in the developmental process. These reconstructions show not only the relation of the venolymphatics to the vascular channels, but the position of the associated nervous structures as well.

In the earliest stage available, lateral diverticula have arisen from both the anterior and posterior cardinal veins. These outgrowths differentiate into purely venous and lymphatic elements. Subsequent fusion of certain of the latter follows, so that in the 5-mm. embryo four discrete lymphatic elements are recognized. Each element retains temporarily its continuity with the anterior cardinal vein. These four elements later unite to form the complete jugular lymph with its venous-lymphatic connections.

The relations of the jugular lymph sac of the newborn mouse and of the adult to the venous system is determined by the injection method, and the comparisons with the later embryonic stages are noted.

38. *The midbrain and thalamus of Ornithorhynchus paradoxus.* MARION HINES-LOEB, Department of Anatomy, University of Chicago.

The morphology of the midbrain resembles that of higher mammals. The tectum is connected with the cerebellum, bulb, cord, pars ventralis, and pars dorsalis thalami. The tegmentum has fiber relationships with the telencephalon, the pars ventralis, the hypothalamus, medulla, and cord. The pes pedunculi are small, the ganglion interpedunculare, an important motor center.

The usual divisions of the thalamus are found in the epithalamus and hypothalamus. But in the pars dorsalis thalami, the nucleus lateralis and pulvinar are difficult of separation from the nucleus medialis anteriorly and the pars intercalaris posteriorly. The nucleus lateralis shows no defined differentiation except that made by the entrance of the medial lemniscus lateroposteriorly and the trigeminal ventromedially. The spinal was not identified. The pars ventralis thalami contains four nuclei, distinguished by position, size of cell, and fiber connections. Neither the lateral nor medial geniculate body is visible on the surface.

The fiber systems of the epithalamus arise in the lower olfactory centers or the olfactory cortex and discharge into the motor centers of the tegmentum and hypothalamus. The fiber connections of the hypothalamus relate it to the secondary olfactory centers, the habenula, the hippocampus, the nucleus anterior, and the tegmentum. The pars ventralis is connected with the midbrain, corpus striatum, amygdala, and nuclei medialis et anterior. In the pars dorsalis the typical mammalian connections are visible.

39. *The effect of acetyl thyroxin on the young mammal.* MARGARET M. HOSKINS, University of Arkansas Medical School.

The acetyl derivatives of thyroxin has been shown to affect the development of tadpoles, although it does not change the metabolic rate of adult mammals. The experiments to be reported were designed to test the effect of acetyl thyroxin on newborn mammals. Injections of 0.1 mg. each were given to newborn white rats. The following changes were noted: Within forty-eight hours the bones of the heads of injected animals show an increase in size and a change in shape toward the condition of the adult rat. The next difference to be seen is the eruption of the lower teeth, which occurs two or three days earlier in injected than in control specimens. About this time also a precocious development of hair is noticeable in the injected rats. The eyes open two to four days earlier than the eyes of the controls. Finally, in males the descent of the testicles may take place as early as the fifteenth day. By the time the rats are thirty days old most of the differences have disappeared and the two sets are practically indistinguishable. The conclusion is that thyroxin acts as a stimulator of development in young mammals and that this action is separable from the acceleration of metabolism already so well known.

40. *The development of the temporary sexual characters in *Diemictylus viridescens* in relation to changes within the testis.* R. R. HUMPHREY, School of Medicine, University of Buffalo.

Diemictylus males, during the mating season, possess a number of temporary sexual characters which undergo regression or entirely disappear during the period of sexual inactivity. These include, 1) the structure and secretory activity of the cloacal glands, the wolffian duct, and the excretory canals of the mesonephros; 2) the secretory activity of certain cutaneous glands of the head; 3) the tail crest or fin, and, 4) the horny areas or pads on thighs and toes.

The development of these characters is apparently not initiated by the formation of any special glandular tissue within the gonads. Modified stromal elements (interstitial cells) are lacking until the spermatozoa begin to leave the testis; the so-called endocrine transformation of the Sertoli cells in emptied tubules likewise does not occur until this time. Yet all the temporary characters may be found either partially or fully developed in males in which no spermatozoa have left the tubules and no 'glandular tissue' has made its appearance. Changes in the cloacal glands may begin several weeks before this time; other characters are less advanced in their development, and appear only shortly before emptying of the tubules begins.

The development of the temporary characters of the mating period in *Diemictylus* would appear to be initiated by changes either in the germ cells themselves or in the related follicle (Sertoli) cells.

41. *Some aspects of bone variability.* N. WILLIAM INGALLS, Western Reserve University.

We have pointed out recently (*Am. J. Phys. Anthropol.*, vol. 7) that the diaphysis of the femur, in white males, is definitely more variable than the epiphyses.

Further observations show that the distal portion of the diaphysis, especially in its transverse diameters, is the most variable part of the entire bone. The epicondylar breadth is the most constant dimension of the bone, while a few centimeters above is a region in which the variability is more than twice as great. The lower part of the femoral shaft may be narrow, a primitive type, or wide and flaring like the fetal condition. It is this part of the bone which is most sensitive to a variety of conditions and also the part most frequently involved in distinctly pathological processes, either invectious or neoplasms. Its close proximity to the knee-joint and the paramount importance of the latter for the difficult erect position, may have left, or maintained, this part of the femur in rather labile equilibrium, in a condition favorable to adjustments which could be effected in the diaphysis more easily than in the epiphysis.

The other side of the picture is the increased vulnerability of the femur at the site in question.

42. *Compensatory renal hypertrophy after unilateral nephrectomy in albino rats with spontaneous(?) nephritis.* C. M. JACKSON, Institute of Anatomy, University of Minnesota, Minneapolis.

Nephritis was found prevalent in our rat colony, which had been fed the McCollum-Greenman cereal mixture (plus 5 per cent whole milk powder, with raw cabbage and liver weekly) during the past year. The nephritis usually appeared chronic, showing comparatively slight effect on growth and body weight. In sixty-five rats examined, the kidney weights were usually close to Donaldson's norm. The difference between right and left kidney weight in the same rat averaged only 4.6 per cent, the right being usually the larger.

The renal surface generally appeared slightly pitted or granular. Histologically, a peculiar interstitial nephritis was found, with variable regional involvement of cortex and medulla. Some renal tubules were obstructed, resulting in marked, characteristic dilatation.

In twelve male nephritic rats eight to nine months old (body weight 205 to 240 grams) the right kidney was removed. Similar diet was continued. The wounds healed promptly. Excepting three cases (dying in nine to twenty-four days with little change in kidney weight), the rats were killed at intervals after seven to forty-eight days. In spite of marked losses (10 to 38 per cent) in body weight, the remaining left kidney became 10 to 122 per cent heavier. This increase after unilateral nephrectomy was apparently due chiefly to increased dilatation of tubules, but partly to parenchymatous hypertrophy. No effect appeared in the kidneys of six control rats operated without nephrectomy.

43. *Metaplastic development of erythrocytes in lymph nodes.* H. E. JORDAN and HARRY T. MARSHALL, Medical School, University of Virginia.

Clinically, the case studied appeared to be one of mixed leukemia. Necropsy findings and histologic data are those of atypical pernicious anemia. Our special interest centers on the erythrocytogenic activity within the lymph nodes. The marrow gives a picture of lymphoid proliferation. Nucleated reds, rare in the circulation, are numerous in the marrow; megakaryocytes and platelets are scarce. The enlarged spleen had been altered by radium treatment. The lymph nodes, packed with lymphoid cells, show all stages of erythrocyte formation;

granulocytes are scarce, basophils predominating. It is impossible to distinguish between the primitive ancestor of erythrocytes and small lymphoid cells.

The following interpretation is offered: The intense anemia exhausted the marrow and this, together with irradiation of the spleen, stimulated compensatory erythrocyte formation in the lymph nodes. This finding bears directly upon the monophyletic theory of blood-cell origin, and indicates close genetic relationship between lymphoid cells and the erythroblasts.

44. *A study of the nervous tissues of albino rats fed on a vitamine-free diet.*

H. M. KINGERY and JESSIE ROBERSON KINGERY, School of Medicine, University of Colorado.

Albino rats fed on a diet deficient in vitamins A and B developed paralysis of the hind legs and cerebellar disturbances in four weeks to three months. Rats on this diet with butter added developed the same symptoms, without, however, the appearance of xerophthalmia. This beriberi syndrome was evidently due to a lack of vitamin B.

Purkinje cells of the cerebellum, motor cells of the spinal cord, and cells of spinal and sympathetic ganglia, of these rats showed consistent and characteristic changes. In most cases two types of degenerative changes were seen in material stained by the Nissl method: shrunken, deeply staining cells, and swollen, lighter staining cells. The 'unstainable substance of Nissl' became more or less deeply stained. The neuroglia cells in these rats showed a tendency toward proliferation and a change in appearance. The cells of the spinal ganglia showed very slight changes and were more nearly normal than any of the other cells.

The sciatics, vagi, and ventral roots of the lumbar spinal nerves showed Marchi degeneration, although capriciously and with no relationship to the severity of the paralytic symptoms.

45. *The development of the marginal sensory zone of the neural plate in Rana.*

R. A. KNOUFF (introduced by C. Judson Herrick), Ohio State University.

An examination of the primitive neural plate reveals the presence of Kingsbury and Adelmann's ('24) longitudinal zones. A marginal sensory zone, corresponding to the placodal zone of the schema forms a well-defined thickening of from one to two layers of high columnar cells on the peripheral border of the neural plate between the neural-crest zone and the general body ectoderm. Unlike the lateral-plate zone and the neural-crest zone, whose boundaries become obscure in the cephalic region of the neural plate, the marginal sensory zone can be traced as a continuous structure to the anterior borders of the plate where it joins its fellow of the opposite side. Its subsequent development can be, therefore, definitely followed.

When the neural tube develops, the marginal sensory zone is not included in its walls, but remains stranded in the surface ectoderm, where it forms a continuous longitudinal thickening in the dorsolateral region of the body. Anteriorly, this thickening gives rise to an anteromedian hypophyseal anlage and anterolateral olfactory placodes. In the posterior head region it differentiates into dorsal lateralis and ventral epibranchial divisions. The dorsal lateralis placodal division develops a series of ganglionic placodes alternating with a series of epibranchial ganglionic placodes. The epibranchial division gives rise to a series of epibranchial ganglionic placodes. In the trunk region the marginal sensory zone remains rudimentary and gradually disappears.

46 a. *The differentiation and growth of Anisolabis ova.* S. I. KORNHAUSER, University of Louisville, Medical School.

Near the apex of the long, narrow ovarioles differential mitoses occur in groups of four. About one centrosome of each oogonium in metaphase occurs a peculiar halo of cytoplasmic material staining purple with crystal violet. All twenty-six chromosomes divide equally, but the daughter cell receiving in addition the material about the centrosome becomes the oocyte; the sister cell, its nurse. The two cells remain in intimate contact during the entire growth period. First, the oocyte enlarges and goes through the process of syndesis. After this the nurse cell starts its activity. It outgrows the ovum greatly. Its nucleus becomes immense, irregular in form, reaching to all parts of the cytoplasm. The oocyte is soon provided with a follicular epithelium, which, however, does not cover the nurse cell and remains as a delicate squamous layer bordering the nurse cell. The oocyte retains a rather small round nucleus compared to the amoeboid-like nucleus of the nurse. Gradually the storage of food in the oocyte changes the character of this cell. It becomes laden with angular closely packed yolk granules, large globules of fat, and a moderate amount of glycogen, outgrowing the nurse cell many times.

The activity of the nurse cell during this storage has been studied by means of histochemical methods and an attempt is made to correlate the morphological changes in the nuclei with the inclusions found in the cytoplasm of the nurse cell and the oocyte.

46 b. *A contribution to frozen-section technique.* S. I. KORNHAUSER, University of Louisville, Medical School.

A microscopical study of adipose tissue and the study of fat deposit often require frozen sections. Adipose tissue and yolk-laden ova both offer obstacles to the freezing method. In the former the sections are difficult to handle and straighten out and in the second the material crumbles under the knife or in the staining fluids. To overcome this, formalin-fixed material was put into commercial liquid glue overnight in a closed vessel. It was then embedded in glue by immersing in a solution of 10 per cent formaldehyde, which coagulates the glue, giving it the consistency of celloidin. After coagulation, the embedded material can be put into weaker formalin. The tissue, surrounded by a good layer of embedded material, is put onto the disc of the microtome, a few drops of water added, and frozen by CO₂. The blocks cut exceedingly well, the sections are flat and can be handled as easily as celloidin sections. Sections were passed through alcoholic and aqueous stains, such as Nile-blue sulphate or Sudan IV, and mounted in levulose. By this method sections were obtained which were impossible by ordinary freezing methods. In cutting ova, it was found best to use thinned liquid glue and then follow this by the undiluted product previous to embedding. It might be added that several new American Sudan IV's tested for the Commission on Biological Stains were used on these sections and proved to be superior in shade and depth of color to those formerly imported.

47. *Migration of medullary cells into the ventral nerve roots and their rôle in the development of the sympathetic trunks.* ALBERT KUNTZ, Saint Louis University School of Medicine.

Migration of cells of medullary origin into the ventral spinal nerve roots in vertebrate embryos has been observed by various investigators, several of whom, including the present writer, have maintained that some of these cells become incorporated in the ganglia of the sympathetic trunks. This conclusion was confirmed by the study of embryos of the chick in which the neural crests and varying portions of the neural tube were destroyed by operation at the close of the second day of incubation (Kuntz and Batson, '20; Kuntz, '22).

In a recent paper, Müller and Ingvar ('23) take exception to this conclusion and maintain that the neural crests constitute the sole source of the cells which become incorporated in the ganglia of the sympathetic trunks. They also maintain that no cells of medullary origin migrate into the ventral nerve roots either in normal or operated embryos of the chick.

The present paper comprises additional evidence, obtained from normal and experimental embryos, that cells of medullary origin become displaced into the ventral nerve roots and that some of these cells become incorporated in the ganglia of the sympathetic trunks.

- 48 a. *The sympathetic innervation of voluntary muscles and its effect on their contractile power and resistance to fatigue.* ALBERT KUNTZ and ALVER H. KERPER, St. Louis University School of Medicine.

Unmyelinated nerve fibers of sympathetic origin which terminate on muscle fibers are described in preparations of muscles of mastication and intercostal muscles of dogs in which the somatic nerve fibers had undergone degeneration following section of the corresponding nerve roots. These findings corroborate the results of the experimental anatomical studies of Boeke ('13), Boeke and Dusser de Barenne ('19), and Agduhr ('19).

Graphic records of the contractions of the gastrocnemius muscles in both hind limbs of dogs, following unilateral extirpation of the sympathetic trunk in the lumbar and sacral regions, indicate no appreciable difference in the initial contractile power of these muscles. However, when both sciatic nerves were stimulated by means of tetanizing currents of equal strength, the gastrocnemius muscle on the side in which the sympathetic trunk was left intact resisted fatigue longer than the one on the side of the operation. Records taken after the sympathetic fibers supplying the muscles had undergone degeneration, following extirpation of the lumbar and sacral sympathetic trunk, indicate greater reduction in the resistance to fatigue of the gastrocnemius muscle than those taken immediately following operation.

- 48 b. *Posture of the extremities as related to the sympathetic nervous system.* ALBERT KUNTZ and ALVER H. KERPER, Saint Louis University School of Medicine.

Pigeons subjected to unilateral section of the sympathetic trunk just posterior to the stellate ganglion, others subjected to unilateral section of the dorsal roots of the brachial nerves, and still others subjected both to unilateral section of the dorsal roots of the brachial nerves were studied. In the first and second series

the wing involved rested in a position somewhat lower than normal. When the wing was passively placed lower, it returned to its former position in the first series, but tended to remain in its new position in the second series. In the third series the wing involved rested in a lower position than in the first or second series. When passively placed in a higher position, it tended to drop back. These observations agree in general with Hunter's ('24) observations on the fowl, which he interpreted as indicating that the plastic tonus of voluntary muscles is maintained through their sympathetic innervation.

Dogs in which the sympathetic innervation of one limb was eliminated by extirpation of the corresponding portion of the sympathetic trunk showed no significant changes in muscle tonus or posture of that limb during normal behavior. When they were subjected to surgical anesthesia, in a recumbent position, the limb involved dropped lower and was more completely flexed than the limb of the opposite side.

49. *The relative postnatal growth of the systems and organs of the chicken.*

HOMER B. LATIMER, Department of Zoölogy and Anatomy, University of Nebraska.

The weights of the systems and organs of 100 single-comb White Leghorn chickens expressed as ratios of the hatching weight increase from hatching to maturity, with the exception of the thymus and the feathers. The maxima for these come before maturity. The entire body weight increases seventy times from hatching to maturity; the thyroid, musculature, and pancreas increase more than seventy times, and all the other organs increase less, the nervous system increasing the least, or but seven times.

The percentage values expressed as multiples of the percentage at hatching taken as unity have been plotted and the resulting charts will be shown. There are four general types of curves.

1. Curves which decrease throughout, including the hypophysis, nervous system, eyeballs, head, stomach, digestive tract, gizzard, and suprarenals.

2. Curves with a maximum between hatching and maturity and ending in a ratio less than unity, include the thymus, intestines, liver, skelëton, pancreas, heart, and kidneys.

3. Curves attaining a maximum before maturity and which terminate in a percentage greater than unity are the feathers and the spleen.

4. Curves which rise to their maximum at maturity include the musculature and the thyroid.

The maximum percentage values for the various organs have been tabulated and several of these maxima occur earlier in the chick than in the rat, due probably to the more active life of the chick at hatching.

50. *Studies on the retinae, with special reference to the fovea centralis, of pairs of human eyes.* P. E. LINEBACK, Emory University, Georgia.

Double visioning has received attention from various sources—physiology, psychology, and even applied mechanics—with much left indefinite and unclear.

This study is an attempt to approach some phases of these fields by a study of the structure of the retinae, and especially the macula, of the two eyes of the same individual. Thus far attention has been focused upon the grosser more general features, but even here several items of interest appear. In the

material covered the fovea in the right eye is closer to the entering optic nerve than the left fovea is to its nerve. Peculiar variations in shape are noted in the fovea, possibly artifacts, or pathology, but they appear in mirror pattern with striking harmony between the two eyes.

51. *The development of the vena cava inferior in man.* CHARLES F. W. McCLURE and ELMER G. BUTLER, Princeton University.

In man, as in the cat (Huntington and McClure, *Anat. Rec.*, vol. 20), the inferior vena cava is composed of four embryonic subdivisions: Pars hepatica, pars subcardinalis, pars renalis, and pars supracardinalis. While development of the cava is essentially the same in both cases, nevertheless minor differences are found in the relative functional rôle played by certain embryonic veins during the course of ontogeny.

In man the posterior cardinals disappear at a relatively early stage. The lumbar subcardinal veins which drain the gonads retain their independence and individuality throughout all stages of development and enter directly into the formation of sex veins in the adult.

In the cat, on the other hand, posterior cardinal veins play an important functional rôle until a relatively late stage. The lumbar subcardinal veins fuse with the posterior cardinals, and so soon lose their original independence and individuality. The gonad drainage is thereby shifted to the posterior cardinals which form a definite portion of the sex veins of the adult cat.

The relatively early degeneration of the posterior cardinal veins in the embryo of man, as compared with that of the cat, is undoubtedly associated with the fact that, while an atypical condition of the venous system in which the posterior cardinals are concerned is rarely found in adult man, this is of frequent occurrence in the adult cat.

52. *Cell structure of the cerebellar apparatus.* EDWARD F. MALONE, University of Cincinnati.

It is the purpose of this paper to call attention to the fact that all cells within the cord and brain stem sending axones to the cerebellum show an efferent type of structure and to discuss briefly the significance of this fact.

As noted in previous papers, all efferent cells are characterized by discrete and relatively coarse Nissl granules; such cells belong either to peripheral efferent neurones or else to efferent coordinating neurones. The cells, other than those of the vestibular ganglion, which are known to send axones to the cerebellum, are located in the following nuclei: column of Clarke, vestibular nuclei, lateral reticular nucleus, inferior olive, arcuate nuclei, and nuclei pontis. The cells of all of these nuclei as well as the Purkinje cells and those of the internal cerebellar nuclei are definitely efferent in structure.

The cerebellum is an elaboration of the vestibular nuclei, and the fact that these nuclei send axones to the peripheral efferent cells and have no pathway to the cerebral cortex is in agreement with the efferent structure of other cells whose axones reach the cerebellum. The entire basal portion of the brain stem is efferent and the corticopontine pathway is merely a part of the cortical efferent projection system and cannot be considered afferent to the cerebellum.

53 a. Behavior of blood leukocytes in tissue cultures. ALEXANDER A. MAXIMOW, University of Chicago.

Leukocytes of the blood of the rabbit, when explanted, behave in the same way as in inflamed tissue after emigration out of the blood vessels. The granulocytes gradually degenerate, whereas the lymphocytes and the monocytes remain alive and show progressive development. The monocytes at once begin to hypertrophy and transform themselves into large ameboid and phagocytic elements, the polyblasts or macrophages; their protoplasm contains fat-droplets and engulfed material. The lymphocytes also gradually hypertrophy and sooner or later join the monocytes in their transformation into polyblasts. After four or five days, the polyblasts excessively hypertrophy, become transformed into large epithelioid cells, and proliferate mitotically. If the medium contains lithium carmine, they store the dye in granular form. In cultures of blood leukocytes inoculated with tubercle bacilli the lymphocytes and monocytes assemble into clusters around the bacilli and both become transformed into large epithelioid cells, phagocytizing bacilli.

53 b. Behavior of endothelium of blood vessels in tissue cultures. ALEXANDER A. MAXIMOW, University of Chicago.

The true endothelium, for instance in the blood vessels of the pia mater, behaves in vitro in a very typical way. Out of the severed end of a vessel a bunch of long, slender, fusiform, proliferating cells grows out; they never produce wandering cells, but very soon join the fibroblasts in their further development and cannot be then distinguished from them.

The cells of Kupffer, lining the capillaries in the liver, when explanted, are mobilized and appear as large, ameboid, phagocytizing, and carmine-storing macrophages. This cannot, however, be considered as a proof of the capacity of endothelium to produce wandering cells; it merely demonstrates that the cells of Kupffer are not true endothelium, but histiocytes.

54. Some connections of the corpus striatum in the human brain. L. O. MORGAN (introduced by James W. Papez), Department of Anatomy, Cornell University Medical College, Ithaca.

Material for this study consisted of six human brains with lesions in the corpus striatum and one with the internal capsule degenerated.

A fasciculus of considerable size arises in the globus pallidus, passes caudodorsally through the cerebral peduncle beneath the lateral border of the corpus subthalamicum, thence caudally and dorsally upon the dorsal surface of the peduncle, and enters the lateral portion of the medial lemniscus at the level of the decussation of the brachium conjunctivum. These fibers seem to end in the masticator nucleus. This fasciculus receives additional fibers in passing through the cerebral peduncle, suggesting that it may be identical with the lateral pontine bundle of Schlesinger or associated with the lateral pes lemnisci.

The ansa lenticularis and fasciculus lenticularis (Forel's field H_2), arising in the globus pallidus, meet medial to the basis pedunculi in the lower part of Forel's field H. From this area a broad band of fibers sweeps dorsally through the capsule of the red nucleus on its medial and ventromedial side, closely associated with the mammilotegmental fasciculus of Gudden. These fibers take a position in the tegmentum lateral to the median longitudinal bundle.

55. *Oestrous cycle in the domestic cow (Bos taurus). Effects of ovarian extracts (sixth report).* H. S. MURPHEY, G. W. McNUTT, B. A. ZUPP, W. A. AITKEN, Department Veterinary Anatomy, Iowa State College.

Material and methods: Sterile follicular fluid from healthy cows only, diluted with physiological salt solution, administered intravenously, a dose being the equivalent of fluid from one ovary.

Tests: I. To prove specificity of oestral hormone. a) With spayed cows we produced a slight 'heat,' all of the nervous symptoms, 'attitude,' secretory and vascular phenomena, but not complete cytological changes, growth, or infiltrations. b) With spayed bitches the vulva failed to enlarge, but the secretory picture, by the smear method, simulated heat. c) With pregnant cows heat was produced, coitus accepted.

II. On functionally sterile cows. (No abnormalities or disease detected by vaginal speculum and rectal palpation.) a) With animals not coming in heat, heat was produced. In eighteen days a second dose was administered and animal bred at second heat period. Fifty per cent of animals became pregnant. b) With animals coming in heat regularly or irregularly, but sterile when mated to bulls known to be potent. Fifty per cent became pregnant.

Corpus luteum: Sterile physiological salt-solution extracts were given in daily doses of one corpus luteum. The extract was mixed or was grouped in ages of 1 to 5, 6 to 10, 11 to 15, days and given at corresponding times of cycle. This had no effect on the normal oestrous cycle.

56. *A quantitative study of the seminiferous tubules of normal testicles.* H. L. OSTERUD and K. F. BASCOM, Department of Anatomy, Medical College of Virginia.

Normal testicles of the albino rat, guinea-pig, cat, dog, man, pig, sheep, and bull were quantitatively studied. Diameters of tubules in adult animals were, in round numbers, as follows: cat 0.18 mm., man 0.18 mm., dog and sheep 0.21 mm., rat, guinea-pig, and bull 0.24 mm. To make up the volume of 1 cc., 39 meters of tubules like those of the cat are required, while for tubules of the diameter of those of the bull or guinea-pig only about 22 meters are necessary. Total lengths of tubules are calculated to be in round numbers: rat, guinea-pig, and cat 20 to 26 meters, dog 140 meters, man 250 meters, pig 3200 meters, and bull 5000 meters.

Such evidence as is available indicates the probability that longitudinal growth of seminiferous tubules may be practically completed before these tubules have attained their maximum diameter, i.e., before sexual maturity. This study indicates that there is not necessarily a direct correlation between testis weight and total tubule length, since both tubule diameter and pattern of the testicle are variable, the latter being especially so.

57. *Subdivisions of the facial nucleus in the cat.* JAMES W. PAPEZ, Cornell University Medical School, Ithaca.

In a number of cats various branches of the facial nerve were extirpated in such a way as not to interfere with the remaining ones. After sixteen days, the medullae were serially sectioned and stained by the Nissl method for chromatic changes with the following results:

1. Extirpation of the zygomaticofrontal branch produces chromatic changes in the group of large dorsolateral cells of the facial nucleus.
2. Extirpation of the small buccinator (branch of the foregoing) produces changes in the small group of large ventromedial cells.
3. Extirpation of both labial branches produces chromatolysis of the large group of large ventrolateral cells and the group of small ventro-intermediate cells.
4. Extirpation of the anterior auricular nerve produces changes in the lateral part of the large medial group of cells.
5. Extirpation of the posterior auricular nerve produces chromatic changes in very large medial groups of small cells (exclusive of latter).
6. When the entire facial nerve is removed, cells of the entire nucleus undergo marked changes, and there is a scattered chromatolysis in cells of the inferior reticular nucleus of both sides. Its connections are not known.
7. Extirpation of nerve to posterior belly of the digastric has been done, but results are not yet available.

58. *The developmental topography of the human head and neck as determined by orthoscopic plottings to constant areas.* W. T. PEYTON (introduced by Richard E. Scammon), Department of Anatomy, University of Minnesota.

The head and neck were dissected and drawn by the orthoscopic method and the resulting plottings reduced to the same surface area. The figures obtained by this procedure show relative rates of growth in various structures and areas are not readily demonstrated by other methods.

One fetus, four newborn infants, a child of the eighth postnatal month, and one adult were studied by this method.

There is a relative decrease in the size of all the bones of the cranial vault. The growth in the parietal bone is greater anteriorly than posteriorly. The 'kyphosis' of the sphenoid is clearly demonstrated.

The orbit and eye shift downward and forward with growth, showing a greater increment of the parts below and anterior to these structures than those above and behind them. The optic chiasma, however, is more constant in position.

The lateral ventricle undergoes no appreciable change in position or relative size when compared with the growth of the lateral area of the head and neck.

Relatively slow growth of the cerebrum and eyeball in postnatal life is demonstrated in a new way by this method.

The fissure of Rolando moves backward with growth. The lateral sulcus is more constant in position. The inferior surface of the temporal lobe remains constant.

59. *The possibilities of experimental research on sound transmission.* A. G. POHLMAN, Saint Louis University.

It was pointed out some years ago that the accepted view of von Helmholtz in relation to the lever action of the ossicular chain was untenable in so far as the transmission of sound to the cochlea was concerned. It was also indicated that a displacement factor in the middle ear, dependent on a movable drum membrane and a relatively fixed foot plate, could be associated directly with

the differences in the sound transmission system of the anurans, the birds, and the mammals. This interpretation assumes the reverse of the Helmholtz conception in that decreases in motion are associated with decreases, not increases, in pressure; in a word, a shock-absorber system. The development of quantitative methods of testing the acuity of hearing both for air- and bone-transmitted sound may therefore be applied directly to the technique employed by Kato and by Obi in the crossed reflex to the intrinsic ear muscles.

The present research has been made possible through the courtesy of Col. George Fabyan and through collaboration with Dr. F. W. Kranz. We have already demonstrated that air- and bone-transmitted sound pass through all or part of the same route in reaching the cochlea. If the mechanical relations may be established, then there is a probability that animal experimentation may lead the way toward relieving certain types of deafness in the human being, particularly those in whom the bone transmission is fairly good and the air transmission markedly reduced. This work implies a comparative anatomical and physiological consideration of the middle ear complex without reference to the cochlea itself or to any specific theory of hearing.

60. *Further studies of Ferrata's hemohistioblasts.* ADOLPH R. RINGOEN, Department of Animal Biology, University of Minnesota.

The presence of so-called 'hemohistioblasts' and their derivatives (granulocytic, lymphocytic, and monocytic) in the circulating blood of all leukemic cases prove, according to Ferrata and his followers, that the hemohistioblasts (resting wandering cells of Maximow, elasmatoocytes of Ranvier, and the reticulo-endothelial cells) play an exceedingly important rôle in leukemic cytohematogenesis.

Previous investigation (Ringoen, '24), however, has shown that Ferrata's so-called 'hemohistioblasts' are not found in every leukemic blood smear; they are not present in freshly stained (brilliant cresyl blue) or unstained leukemic blood preparations; that damaged promyelocytes, myelocytes (Naegeli), and lymphocytes may take on the characters of Ferrata's so-called 'hemohistioblasts.'

It has been further ascertained from comparative studies of myelogenous leukemic smears and rabbit and lymph-node smears—dry smear method—that the so-called 'hemohistioblasts' are not circulating reticulo-endothelial cells in various stages of differentiation (Ferrata and others).

It has been still further ascertained from studies of the material (myelogenous leukemic smears) that the so-called 'hemohistioblasts' of Ferrata may be of lymphoidocytic (stem cell) or leucoblastic origin. Evidence of their origin from these sources is especially convincing, particularly so for those types of Ferrata cells that resemble sprawled-out *Ameba proteus* specimens.

Presentation of evidence shows that Ferrata's so-called 'hemohistioblasts' cannot possibly be interpreted as histoid elements, but that they are damaged blood cells of various types.

61. *Crown-heel and crown-rump length in the fetal period and at birth.* RICHARD E. SCAMMON and LEROY A. CALKINS, Department of Anatomy, University of Minnesota.

Both the crown-heel and the crown-rump length have been used extensively as standard measurements for fetal and newborn material, but there seems to be no detailed study of their relative accuracy.

Experimental studies of the effects of simple preservation and of injection with subsequent preservation indicate that the average relative error produced by these factors is about the same for both measurements.

Experimental and statistical studies were made of the error of actual measurement of preserved, fresh-dead, and living material. The error of measurement of living individuals is the greatest, that of fresh specimens is next, and that of preserved material is the least. Large series of measurements of single specimens indicate that several factors influence the determination of length and that these errors do not show a strictly symmetrical distribution. The error in the determination of crown-heel length of all three classes of material seems somewhat less, relatively, than that of the crown-rump length.

A critical study was made of the various published interpolation formulae for these measurements. These published formulae were compared with other empirical expressions developed by graphic methods, by the method of means and by least squares. Our study indicates that all these formulae are of a simple linear type and that the results of most of them lie well within the limits of experimental error.

62 a. *The growth response of the thyroidless and hypophysectomized rats to injections of thyroid extract.* PHILIP E. SMITH and CHARLES F. GREENWOOD, Department of Anatomy, University of California.

We have found that the deficiency in body weight and in skeletal growth which results from thyroidectomy in the rat can be completely remedied by continued small injections (0.08 cc. per 100 grams body weight) of an extract prepared from fresh sheep thyroids. Similar thyroid injections in two rats which have been dwarfed by hypophysectomy have failed to stimulate their growth in any decisive fashion. Injections of fresh anterior-lobe extract, however, resulted in rapid growth. It is well known that thyroidectomy causes structural alterations in the anterior hypophysis. These, according to Trautmann, are degenerative in character. From these facts it seems highly probable that the thyroid injections cause growth in the thyroidless rat not by a direct action of this hormone on the general body tissues, but through an influence upon the anterior lobe which results in the elaboration of the hypophyseal hormone. It is known clinically that some dwarfs respond by growth to thyroid treatment; others fail to do so. It seems likely in these cases that the presence or absence of a growth response depends upon the capacity of the anterior lobe to respond to the thyroid treatment as in our two experimental types.

62 b. *Disturbances resulting from experimental lesions of the hypophysis and the adjacent region of the brain in the rat.* PHILIP E. SMITH and CHARLES F. GREENWOOD, Department of Anatomy, University of California.

The three types of operation upon the hypophysis and the adjacent brain region used by us have resulted in somewhat selective and dissimilar effects.

Injection of chromic acid into the hypophysis induces pronounced adiposity. One of our operated females weighs 820 grams; its control 304 grams. The total length of the two is identical. Retardation in skeletal growth (dwarfing) and atrophy of the thyroid and adrenal cortex, which also may result from this operation, appear to be in direct ratio to, and the adiposity independent of, the hypophyseal damage. Ovarian atrophy is always found.

Injury to the hypophysis with a weak electric current causes dwarfing without adiposity, but accompanied by atrophy of the ovaries, thyroids, and adrenal cortex. Adiposity may be superimposed on this when a stronger current is used.

Intentional injury to the tuber cinereum with chromic acid (not involving the hypophysis) results in adiposity and ovarian atrophy with little or no reduction in the size of the adrenals and thyroid.

We have thus far failed to correct by anterior-lobe therapy the adiposity or the ovarian atrophy. Dwarfism is corrected by this treatment.

Results obtained thus far indicate that the adiposity is due to brain injury, the thyroid and adrenal atrophy to hypophyseal lesions, and that ovarian atrophy results from either type of injury. The rôle of the pars tuberalis in these disturbances is not determined.

63 a. *The significance of changes in the thymus glands of thyroid-treated frog tadpoles.* C. C. SPEIDEL, Laboratory of Histology and Embryology, University of Virginia.

The normal thymus glands in frog tadpoles consist almost entirely of lymphoid aggregations interspersed with large blood sinuses. They function as lymphocytopoietic organs, with possibly also a slight erythropoietic function.

Administration of thyroid extract to the tadpoles brings about definite changes in the thymus glands. Lymphocytes, especially the larger ones, are stimulated to mitotic proliferation. The blood sinuses become reduced in size. The hyperplasia of lymphoid cells is followed by their extensive ameboid migration into the blood sinuses and thence into the general circulation. Increased production of lymphocytes is not restricted to the thymus glands, but occurs in many regions of the body. There is, thus, a general lymphoid reaction to hyperthyroidism.

Excess thyroid autacoid acts upon various types of undifferentiated cells to cause mitotic division. Of the blood cells lymphocytes are the undifferentiated type. In the tadpole and frog they function as blood mother cells for erythrocytes, granulocytes, and monocytes. The new metabolic conditions of hyperthyroidism establish a need for more erythrocytes, as well as granulocytes and monocytes. The lymphoid hyperplasia is regarded as the preliminary phase of the response on the part of the body to supply these cell types.

The possibility is suggested that the lymphoid hyperplasias associated with human exophthalmic goiter, which reach their extreme form in status lymphaticus, are of the same fundamental nature and significance.

63 b. *Experimental hyperthyroidism and the germ glands, with special reference to the primitive interstitial tissue.* C. C. SPEIDEL, Laboratory of Histology and Embryology, University of Virginia.

Experimental hyperthyroidism in frog larvae (*Rana clamata*) brings about increased rate of mitotic proliferation of the undifferentiated cells of the germ gland. This increase in mitotic rate is most conspicuous in the case of the interstitial cells. The spermatogonia and oogonia are stimulated to a somewhat less degree. These effects may be well seen about a week after the first administration of thyroid extract. The mitotic rate of highly differentiated cells, such as the oocytes and the follicle cells surrounding them, remains unaffected. The

germ glands, therefore, in spite of the apparent absence of any acceleration of differentiation or maturation, can by no means be considered as being sharply distinct from the rest of the body in the general reaction to hyperthyroidism.

The effect of hyperthyroidism upon the primitive interstitial cells suggests a part of the mechanism by which early maturity in secondary sexual characteristics is attained by hyperthyroid individuals and, conversely, the mechanism by which retarded or late maturity in secondary sexual characteristics results in hypothyroid individuals.

64 a. On the transplantation of neural-crest cells in early embryos of Amblystoma punctatum. L. S. STONE, Yale University, School of Medicine.

In previous papers it was shown that when neural-crest cells in the cranial region were removed in early stages of amphibian embryos, deficiencies occurred in cartilages of the visceral skeleton on the side of operation.

Further tests of the ability of neural crest to form cartilages have been made by transplantation experiments upon early stages of *Amblystoma* embryos. From the region of the hyoid and first two branchial arches, ectoderm, to which adhered bands of neural-crest cells, was excised and transplanted into a wound previously prepared by removing dermatomes of the sixth, seventh, and eighth somites along with the overlying ectoderm. In most cases the transplant included the auditory placode which, in its new position, usually formed a large cystic ear that displaced surrounding structures.

Beneath the skin the transplanted neural-crest cells form elongated cartilages whose size is largely determined by the amount of crest cells in the graft. An environment of native mesenchyme is not essential for this cartilage formation, for small cartilages are obtained from even a few neural-crest cells.

When larger transplants were made which included dorsal portions of the brain from which neural-crest cells are proliferated, the cartilages failed to attain their normal size. This is probably largely due to mechanical factors produced by the growth of a large transplant within a relatively small wound.

64 b. Heterotopic transplantations of the VII and X lateral-line placodes upon the head of Amblystoma punctatum. L. S. STONE, Yale University, School of Medicine.

A series of experiments were made in the following manner: 1) The pre-auditory lateral-line placode was removed on the right side of a normal-colored *Amblystoma* embryo, and into the wound was placed a postauditory (X) lateral-line placode (rotated 180° anteroposteriorly) from the left side of an embryo stained in Nile-blue sulphate; 2) the preauditory (VII) lateral-line placode from the left side was transplanted under similar conditions in place of the postauditory (X) lateral-line on the right side of another embryo. The rotation allowed in each case the direction of growth of the placode of the graft to assume that of the placode for which it was exchanged. The lateral-line placode of X formed a prominent blue supra-orbital line of sense organs which followed the normal pathway. The ganglion of the graft assumed also the function of VII for which it was exchanged.

The lateral-line placode of VII formed a line of from three to eighteen sense organs which followed the normal direction of either the dorsal or the

midbody line. It never extended the normal length of the line for which it was exchanged, but approached the length it would reach if it were in its normal supra-orbital position. The ganglion of the graft assumed the function of X for which it was exchanged. These findings are similar to those obtained when the gasserian and ophthalmic placodes are interchanged.

65. *Hensen's node.* G. L. STREETER, Carnegie Institution of Washington, Department of Embryology, Baltimore, Maryland.

Hensen's node is not simply the cranial end of the primitive streak, at least in pig embryos, but comes into existence as an additional and morphologically specialized center of ectoderm proliferation just in front of the primitive streak. It proliferates in such a manner as to lay down the notochord, and other than the latter there is no 'head process.' Giving origin to the notochord appears be the particular and only purpose of Hensen's node in this form. The notochord, therefore, is not mesodermal in origin, and the relation it bears to that germ layer is acquired secondarily.

66. *The rate of ossification of long bones of the rat, chick, duck, and goose.*

R. M. STRONG, Department of Anatomy, Loyola University School of Medicine, Chicago.

Graphs have been plotted comparing increase in length of the diaphysis and of the entire bone, including unossified portions. The long bones of the rat, chick, duck, and goose have been used for this purpose. The period involved extends from the first ossification to about two weeks after birth in the rat or after hatching in the birds. The two graphs run nearly parallel, the diaphysis being about 2 to 3 mm. shorter, with infrequent deviations to less than 2 mm. or to as much as 4 mm. The rate of increase in length for both ossification and entire bone was greatest in the chick leg before hatching, especially in the tibiotarsus. Otherwise, the rates are notably similar, and the graphs are relatively straight, considering the small amount of material used and the variability in size and development of bird specimens. There is a slight tendency for both rates to decrease temporarily just after birth or hatching.

67. *Internal nerve plexuses.* WALTER E. SULLIVAN and ARTHUR C. TAYLOR, University of Wisconsin.

In an attempt to find an explanation for the presence of internal nerve plexuses, different types of nerves were chosen for dissection and experimentation. We found them present in the large trunks to the muscles as have other workers and also in the large visceral trunks as the greater splanchnic. There are few or none in the cutaneous nerves of the extremities and in the long nerve roots of the cauda equina. This suggests a developmental basis for their presence, for they are found in nerves supplying structures which have a somewhat complex developmental history, including such factors as migration and torsion, but are less common or absent in nerves where these developmental factors are absent.

68. *The influence of technique in cranial capacity determinations.* T. WINGATE TODD, Western Reserve University.

In most series of crania capacity is estimated by seed or some seed substitute on the dried cranium. By our technique we obtain the capacity with water before

loss of membranes. We have shown that loss of membranes and shrinkage in drying practically compensate for each other. Consequently, the fully dried skull may be aptly compared in capacity with the fresh skull from the dissecting room with membranes still in situ.

Taking a series of forty-six male white crania and measuring capacity by both seed and water methods, Miss W. M. Kuenzel and I have been able to show that on an average the capacity by water technique is 80 cc. less than that obtained by the seed method. We can show by study of the variabilities that neither method is above suspicion and that experience results in mastery of a technique rather than in approximation to absolute accuracy. Nevertheless, we hold that the water method, in its smaller total, gives a truer notion of actual capacity than does the seed technique which has many sources of error beyond control of the operator.

69. *The rôle of the vagus in the colloid release of the thyroid.* E. UHLENHUTH, Department of Anatomy of the Johns Hopkins University.

It is believed that pilocarpine enforces glandular secretion by the stimulation of the vagus, while atropine inhibits it. Administration of pilocarpine to normal salamander larvae (eastern *Amblystoma tigrinum*) and neotenus forms capable of metamorphosis (Mexican axolotl) should enforce metamorphosis, while atropine should inhibit metamorphosis of normal larvae. A series of larvae of the eastern *Amblystoma tigrinum*, near metamorphosis (about 80 mm. long) were put into solutions of pilocarpine, in intervals of from two to four days, for from two to twelve hours. Another series was kept permanently in pilocarpine and still another one for from two to eight hours twice or three times every week from an early larval stage on. Adult neotenus and young larvae of the axolotl were put into pilocarpine for several hours one to seven times. Although severe vomiting, defecalization, secretion of slime, and other characteristic symptoms were produced by the pilocarpine, metamorphosis was neither accelerated nor enforced. Four series of normal larvae were kept continuously in atropine solutions from an early stage on; metamorphosis was not inhibited. Hence it is doubtful that the vagus is involved in the releasing mechanism of the larval salamander thyroid.

70. *The regeneration of the gustatory apparatus in the rat.* BEATRICE WHITESIDE, Washington University, Saint Louis.

The vallate and foliate papillae of white rats were destroyed by the use of an electric cautery. The entire papillae, the underlying connective tissue, and the superficial layers of muscle were removed in this way.

The microscopical examination showed that the wounds healed quickly with new growth of epithelium and connective tissue. New papillae developed and taste buds appeared. The method of formation of these structures was similar to the process of embryological development. The rate of growth varied in the different individuals. Regeneration continued until normal vallate and foliate papillae with the usual number of taste buds were formed. Occasional variations in the development and structure of the papillae and in the number and arrangements of the taste buds were observed.

71. *Non-bifurcating pain fibers of the trigeminal nerve.* W. F. WINDLE, Northwestern University Medical School.

Dr. Margaret Wilson Gerard ('23) has shown clearly that pain is transmitted to the nucleus of the spinal tract of the trigeminal nerve, and not to the main sensory nucleus. Using the pyridine-silver technique she could find no unbranched fibers descending into the spinal tract, so she assumed that at least nearly all of them do bifurcate after the nerve enters the pons. She concluded that both pain and touch are carried by the same fibers in the nerve and that the main sensory nucleus is 'attuned' to touch, while the nucleus of the spinal tract is 'attuned' to pain.

Cajal believed ('96) that all the fibers of the trigeminal bifurcate; but Kölliker ('91) said that he found some which did not. These two men used the Golgi technique. By using the same method, I have obtained preparations in which the trigeminal nerve is impregnated. In most of these preparations non-bifurcating fibers can be traced into the spinal tract. These fibers evidently form a pathway for pain impulses which is separate from that for touch.

72. *The relative volume of the pars tuberalis of the hypophysis.* EVERETT A. WOODWORTH, and WAYNE J. ATWELL, University of Buffalo.

Morphogenetic and histologic studies have shown that the pars tuberalis deserves to be considered a distinct lobe of the hypophysis. To aid in determining whether the lobe is large enough to be considered capable of producing a secretion or whether it is to be considered the vestige of a previously important lobe, recourse has been had to the volumetric method. Our first observations were upon the domestic cat, and we were led to pursue our studies further by finding that in the cat the pars tuberalis is not markedly less significant in volume than the pars intermedia—a lobe which is known to produce the important 'posterior-lobe' secretion. We find that considerable variation exists among various species as to the relative size of the pars tuberalis and the pars intermedia. For example, in adult *Necturus* the pars tuberalis is 66 per cent larger than the pars intermedia, while in *Amphiuma* the pars tuberalis is not quite 20 per cent of the size of the pars intermedia. In certain other tailed amphibia the two lobes are nearly on a parity. Such divergent figures do not help in drawing definite conclusions as to the phylogenetic progress or regression of the pars tuberalis. Two important deductions, however, may be drawn from our data: 1) In a number of vertebrates the volume of the pars tuberalis is equal or nearly equal to that of the pars intermedia; 2) as far as volume is concerned, the pars tuberalis may be capable of producing an important secretion in forms as high as the mammals.

PAPERS TO BE READ BY TITLE

1. *On the constant presence of premandibular head cavities in embryos of the chick and robin.* HOWARD B. ADELMANN, Department of Histology and Embryology, Cornell University, Ithaca.

Although head cavities have been described in embryos of several 'lower' birds (notably duck, gull), the occurrence of head cavities in the chick embryo has not been generally recognized. (But see Edgeworth, '07.) In the chick a small but well-defined premandibular cavity is constantly present. At forty-eight hours of incubation, a definite simple cuboidal epithelium bounds the cavity which is connected with the prechordal mesoderm, and hence with its fellow of the opposite side of the body, by a well-defined strand of mesoderm.

Later, the oculomotor nerve ends in the wall of the cavity. The fact that the cavities are connected across the midline by mesoderm and related to the oculomotor nerve establishes their identity with the premandibular cavities of elasmobranchs and lower forms. The premandibular cavity of the chick collapses shortly after sixty hours, giving rise to a mesenchymal mass innervated by the oculomotor nerve and presumably destined to give rise to certain eye muscles.

A much more prominent—indeed, relatively* enormous—premandibular head cavity with similar prechordal connections in young stages, and similarly related to the oculomotor nerve, has been found by the writer in the robin.

The relation of these head cavities to the eye muscles in both forms is being studied. Investigation will probably reveal the presence of head cavities in a large number of 'higher' birds.

2. *The effect of injections of the ovarian follicular hormone and active extracts of human placenta upon pregnant and lactating rats, their embryos and young.* EDGAR ALLEN, BYRON F. FRANCIS, and OWEN W. CRAIG, University of Missouri School of Medicine and Washington University School of Medicine.

Injections of the ovarian follicular hormone into rats on the fourth day of pregnancy (before the beginning of implantation of the blastocysts) induced a maximum reaction in the genital tract on the sixth day without interfering with normal gestation. Injections on the eighth and twelfth days gave less marked reactions, and those during the latter third of gestation seemed to have no effect upon the maternal genital tract.

Pregnancy apparently inhibits to some degree the action of this hormone, or else the genital organs are so hypertrophied that they will not react further. Double ovariectomy performed upon pregnant rats before injection were made did not alter the reaction. Consequently, the corpora lutea can hardly be the responsible factors.

Histological study of the genital organs of embryos (sixteen to twenty days) from females injected on the fourteenth to eighteenth days of gestation and also genital organs of young nursed by injected mothers showed no appreciably greater development than controls. These animals received from fifteen to forty 'rat units' of the hormone—much greater amounts than present in the animal during oestrus. That the corn oil used as a solvent for the extracts readily passes through both mammary glands and placentae has been demonstrated by staining with Sudan III.

3. *The relation of thyroids and parathyroids to the reaction of the genital tract to injections of the ovarian follicular hormone.* EDGAR ALLEN, J. WILBUR WHITSETT, and JOHN W. HARDY, University of Missouri School of Medicine.

Rats from which thyroids and parathyroids (at least one pair), as well as ovaries, had been removed reacted quite fully to injections of the ovarian follicular hormone. Therefore, whether or not the thyroids and parathyroids are necessary for the elaboration of the secretion of the ovarian follicle, the reaction of the genital tissues to the injected hormone is apparently not dependent upon them.

4. *The vascularity of the lobes of the hypophysis in the rat.* ALAN BROWN (introduced by P. E. Smith), Department of Anatomy, University of California.

Injections of the blood-vascular system show that the neural part of the posterior pituitary is richly supplied with vessels in the rat. Its capillaries (sinusoids) are more numerous than those of the pars anterior and form a close network in contrast to the coarser network of the anterior lobe. Its vessels are about one-half the diameter of those of the anterior lobe and consequently are more difficult to see in uninjected preparations.

Most of the pars intermedia is relatively avascular, containing only a few capillary loops. These arise from the neural lobe. Its thickened horseshoe-shaped periphery is quite vascular.

The pars tuberalis is clearly marked out in injected whole mounts and in sections by its rich blood supply.

If the blood supply of an organ is an index of its activity, we are forced to the conclusion that the activity of the nervous lobe of the pituitary is not surpassed by that of the pars anterior. Its vascularity compares favorably with that of any of the endocrine organs.

5. *Further studies on parathyroidectomy in the rat.* SIMON B. CHANDLER (introduced by Margaret M. Hoskins), University of Arkansas and Northwestern University.

Since our last report on parathyroidectomy in rats, we have studied serial sections of embryos, neck regions, and thymi of newborn and adult rats, in order to determine the percentage of cases showing accessory parathyroids. Eighty-four specimens were examined, showing less than 6 per cent with aberrant parathyroid tissue.

The rats chosen for parathyroidectomy range from fifty days to over four months in age. All material removed in the operation is sectioned and carefully studied. The neck regions and thymi are also sectioned and examined at autopsy. If the two parathyroids removed are of approximately the same size and surrounded by connective-tissue capsules, and if no parathyroid tissue is found in the neck region or thymus, the operation is classed as a complete parathyroidectomy. In thirty-four cases from fifty to eighty days old there were twenty-five of fatal tetany, or 74 per cent; but there was only one fatality among the nine rats over eighty days old.

When the size of the parathyroid in relation to the body weight is plotted on the age of the rat, the curve drops sharply between the sixtieth and eightieth days. At eighty days the index is much lower than at any previous period.

These facts suggest a relation between tetania parathyreopriva and the period of puberty.

6. *Some effects of the application of regulated heat on the retina.* K. S. CHOUKE, University of Colorado, School of Medicine, and Washington University Medical School.

By means of Shahan's electro-thermophore, regulated temperature was applied to the sclera of rabbit's eyes, using a contact surface of 4 mm. in diameter, for a period of one to one and one-half minutes at 130°F. to 160°F., under cocaine-adrenalin anesthesia. The results varied with the temperature, from temporary pigment disturbance for a week or so to simple retinitis with edema and some pigment disturbance. In the experiments that have been made up to the present time, the reactions were only temporary, and the retina apparently returned to normal in from one to four weeks, both ophthalmoscopically and histologically when the temperature used did not exceed 160°F.

This work is still in progress, and attempts will be made to determine the results after longer exposures and higher temperature.

Shahan's electro-thermophore is an instrument that has been used considerably in the treatment of various eye diseases with quite satisfactory results. The object of the present investigation is to determine the danger-point beyond which the eye should not be subjected to heat.

7. *Preservation of fertility in the male rat after extensive treatment with anterior hypophyseal fluid.* JOHN G. CRAFTS and CHARLES F. FLOWER (introduced by Herbert M. Evans), Department of Anatomy, University of California.

The cessation of ovulation in mammals caused by anterior hypophyseal fluid has been shown by Evans and Long to be due to retention of the ova and the conversion of the follicle wall into lutein tissue. The same result has been secured in this laboratory by Albert T. Walker in the hen. It is, however, not clear whether or not we may speak of primary germ-cell injury as resulting from this agent, and we have, accordingly, sought to inquire as to whether or not spermatogenesis is suspended by extensive anterior hypophyseal therapy. Early results led us to believe this, but we have secured repeated instances of fertile males which have undergone for some months the same daily dosage with anterior hypophyseal fluid which in their sisters has led to cessation of ovulation.

8. *The cyclic activity of hair follicles.* C. H. DANFORTH, Stanford University Medical School.

Thirty-four definitely identified hair follicles on the finger have each been followed through from five to ten consecutive cycles. The length of successive cycles is relatively constant for a given follicle. In this series the averages ranged from seventy-three days for a small follicle to 120 days for a large one. The active phase may be shorter or longer than the resting phase, as reported by Trotter for hairs of several other regions. The amount of hair produced in a unit of time is slightly less at the beginning and end of a growth period, but the contention of Bulliard that there is some growth throughout the cycle to compensate for wear was not found to hold for hairs of the finger. Pinkus has recently reported the length of the cycle in certain body hairs to be less in winter than in summer. A slightly larger number of observations on hairs of the finger failed to show this phenomenon. The present study indicates that individual

follicles show a high degree of autonomy, those separated by less than a millimeter often passing through regular cycles wholly unrelated to each other. Nevertheless, the resting period may occasionally be shortened by sunburn and hyperemia or by epilation, if these stimuli are applied when the follicle is in the proper phase.

9. *Leucocytes and growth.* V. E. EMMEL and M. E. FISCH, University of Illinois, College of Medicine.

The results of a previous study on the relation of leucocytes to lactation demonstrated in the albino rat a definite decrease of leucocytes in the circulating blood during active nursing which seems to be due, in part at least, to a migration of leucocytes into the lumen of the alveoli and ducts of the mammary gland (Emmel, Anat. Rec., vol. 25; Streicher and Emmel, Anat. Rec., vol. 27; Weatherford and Emmel, Anat. Rec., vol. 27). In connection with the possible significance or utility of such leucocytic components of milk a series of experiments have been undertaken to ascertain the effect of leucocytes on growth.

One of the results attained at the present stage of the investigation may be briefly presented as follows: In a series of young rats divided into groups as litter mates, half were fed on leucocytes and the remaining animals retained as controls. In a period of forty days the controls gave an average percentage increase in weight of 74, in contrast with a percentage increase for the leucocyte-treated animals of 133. These results are being confirmed and analyzed by further experiments, together with a comparative study of the effect of embryonic tissues.

10. *The behavior of the neutrophiles in relation to mammary secretion.* V. E. EMMEL and H. L. WEATHERFORD, University of Illinois, College of Medicine.

In a previous investigation on the relation of leucocytes to lactation it was shown that in association with the lactation leucopenia occurring during active nursing in the albino rat (Emmel, Anat. Rec., vol. 25) there was a numerical decrease of lymphocytes in the interalveolar regions of the active gland during active nursing as compared with the relatively passive gland of suspended nursing, that these lymphocytes pass into the lumen of the alveoli, become transformed into corpuscles of colostrum, and ultimately undergo dissolution. These results did not furnish adequate evidence in explanation of the fact that in lactation leucopenia the neutrophiles in the circulating blood also undergo a numerical decrease parallel with that of the lymphocytes (Streicher and Emmel, Anat. Rec., vol. 27). Further investigations have disclosed the interesting fact that in the glands of the active nursing rat there is a pronounced increase of neutrophiles in the connective tissue adjacent to the ducts, that they migrate through the duct walls into the lumen with the result that, whereas within the alveoli the ratio of neutrophiles to the lymphocytes was 5 to 55, within the ducts the ratio was found to be 39 to 34. (The results of the entire study will shortly be in press.)

11. *Exfoliation in toto of the vaginal mucosa of the guinea-pig.* EARL T. ENGLE (introduced by A. W. Meyer), Stanford Medical School.

In the course of other investigations it was observed that the vaginal epithelium of the guinea-pig is detached in toto during oestrus in the majority of cases. Many perfect casts have been obtained in which the vaginal mucosa is continuous with that of the cervix and in the majority with 2 to 3 mm. of that in the cornua. Great numbers of leucocytes are present in the folds of this cast which forms the outer envelope of the vaginal plug. If the vaginal cast is removed mechanically as soon as the vaginal wall assumes the pearly white color resulting from separation of the mucosa, the cheesy mass characteristic of oestrus is greatly reduced in quantity or may be entirely lacking. If the cast is not removed, it disintegrates in the course of two or three hours and forms the characteristic cheesy mass. It seems not improbable that the invading leucocytes may supply a lysin which effects the separation of the mucosa and its rapid disintegration. Shedding of the vaginal epithelium of the guinea-pig 'en masse' was mentioned as a rare occurrence by Stockard and Papanicolaou ('19). Desquamation of the uterine epithelium occurs in great patches, but so far no complete casts of the cornua has been obtained.

12. *The repair of dwarfism following thyroidectomy by the administration of anterior hypophyseal fluid.* CHARLES F. FLOWER and HERBERT M. EVANS, Department of Anatomy, University of California.

Litter-mate sister rats were thyroidectomized, the third sister being left undisturbed as a normal control. One of the thyroidectomized sisters was injected daily, intraperitoneally, with our standard anterior hypophyseal fluid in doses beginning with $\frac{1}{4}$ cc. and increased gradually to 1 cc. The experiments were continued for four months. The remaining thyroidectomized animals were permitted to develop a cretinoid condition, characterized patently by undergrowth. Anterior hypophyseal substance always preserved normal growth in those thyroidectomized animals treated with it, the untreated ones exhibiting the customary dwarfism. Cretinoid growth dystrophies may hence be referable to anterior hypophyseal underfunction resulting from thyroid lack and growth resumption with thyroid therapy to the establishment of normal hypophyseal function.

13. *The cytology of the serous fluids in the normal rabbit.* C. B. GORHAM (introduced by A. W. Meyer), Stanford Medical School.

About 1.5 cc. of peritoneal, a few drops to 0.5 cc. of pleural, and 2.5 cc. of pericardial fluid were present in rabbits about six months old. The pericardial fluid was found to be somewhat lighter in color and seemed less viscous, but clotted with about the same speed. The average cell content of the peritoneal fluid was 576, that of the pleural 800, and that of the pericardial, 628 thousand cells per cc. The different cell forms noted were serosal, large and small lymphocytes, basophiles, neutrophiles, degenerate forms, and a few unclassified specimens which may have been of serosal origin. Eosinophiles were not found. The average size of the serosal cells was 15.2μ in all fluids, and they differed markedly from cells obtained by scraping the serous surfaces. Large and small

lymphocytes averaged $9.6\ \mu$ and $6\ \mu$, respectively, the basophiles $5.5\ \mu$ and $10.2\ \mu$, respectively. No lymphocytes were found in the pleural fluid and the basophiles differed decidedly from those in other fluids. Serosal cells were less apparent in the pericardial fluid.

14. *The labyrinth of rats subjected to long-continued rotation. Preliminary report.* HARLEY N. GOULD, Tulane University.

Doctors Griffith and Detlefsen have subjected albino rats to extended rotation, both continuous and intermittent, and reported resulting changes in equilibratory reactions of the living animals.

At the Anatomy Department of Tulane University, heads of eleven of these rats have been serially sectioned and the labyrinths examined, constantly compared with normal rat material simultaneously prepared in the same manner by Prof. Harold Cummins. The material has not shown any constant deviation from the average normal position and orientation of the semicircular canals, maculae, or cristae which could be interpreted as the result of rotation.

Three heads, received from Doctor Griffith, disclosed severe pyogenic infection of the ear which had, in two, reached the internal ear and injured the membranous labyrinth.

Of the eight heads received from Doctor Detlefsen, six showed evidence of past or present middle-ear infection which had not reached the internal ear.

Reconstructions have been made so far of the bony labyrinth and of the maculae and cristae of one of the two uninfected specimens. This animal was reported by Doctor Detlefsen to have been continuously rotated from fertilization through birth and to four months of age, and is therefore considered a test case. These reconstructions and the serial sections of the uninfected labyrinths exhibit no significant differences from the equivalent reconstructions and serial sections from normal rats.

15. *On the migration of ova and a new ovarian hormone.* FRANK BLAIR HANSON and CHARLES BOONE, Department of Zoölogy, Washington University.

Experiment 1: Twenty virgin albino rats were semispayed, mated, and killed upon evidence of pregnancy. Not a single embryo was found on the spayed side, while as many as nine were crowded into the horn of the unoperated side. The mean litter size from the semispayed series was 5.70. The mean litter size of a control litter of related rats was 5.78.

Experiment 2: Semispayed rats produce just as large litters as normal rats. In fourteen albino rats a piece of one oviduct was removed and the cut ends tied securely with surgical silk. The ovary was left intact, except that its eggs could not reach the uterine horn. These females were mated and produced forty-five litters with a mean litter size of 3.80. One ovary produces full litters in the absence of the other; half-litters when both ovaries are present, but only one is contributing to the litter size.

The explanation of these results, tentatively suggested, is, that between the two ovaries there is a reciprocal hormone relationship, each inhibiting the other from growing beyond a certain size or producing over a certain average number of ova per ovulation. In semispaying the remaining ovary is released from the inhibiting action of the other, and hence hypertrophy and full-sized litters.

16. *The cerebellum of Ornithorhynchus paradoxus.* MARION HINES-LOEB, Department of Anatomy, University of Chicago.

This cerebellum is divided into the usual three lobes. The flocculus and para-flocculus of the posterior lobe are confluent laterally with the lateral part of the uvula and the anterior three folia of the nodulus. The middle lobe is not easily separated into midline and lateral hemispheres. Nevertheless, the lateral extension of the medial folia is greater than that of lobulus simplex. The lingula of the anterior lobe is proportionately larger than either the culmen or the lobus centralis.

Of the two nuclei, the medial receives fibers from Dieter's nucleus and the lateral sends fibers to the nucleus ruber, therefore respectively homologous to the nucleus tecti and nucleus dentatus of mammals.

The internal and external arcuate fibers, the vestibulocerebellar tracts, and fibers from the dorsolateral division of the sensory fifth nucleus pass through the corpus restiforme. The brachium pontis is connected with those nuclei which lie on either side of the midline, medial to the ventromedial border of the sensory nucleus of the trigeminus. The brachium conjunctivum contains three important pathways, the tractus cerebelloruber, the tractus cerebellothalamicus and the tractus cerebellotegmentalis.

Three groups of fibers connect the cerebellum with the tectum via the anterior medullary velum. Two arise in the stratum opticum, while the third appears near the large cells of the mesencephalic nucleus of the trigeminus.

17. *Experimental acceleration of mesonephric growth in the amphibian embryo.* RUTH B. HOWLAND, Washington Square College, New York University.

The effects of unilateral removal of a pronephros in *Amblystoma punctatum* are not restricted to the integral parts of the larval excretory system. Ventral dissection of operated animals shows an appreciable difference in the size of the developing mesonephroi. Anteriorly the tubules by their greater bulk give evidence of greater secreting surface, and posteriorly the centers of tubule formation extend to a greater distance than those on the unoperated side. The histological study of this region is now in progress.

Acceleration in growth rate may also be brought about by removing a portion of the segmental duct immediately posterior to the pronephric coil, thus establishing a physiological block. This block is of a temporary nature, as regeneration of the duct follows in all cases. Conclusive evidence of resumption of function in the regenerated duct is obtained by removing the pronephros on the opposite side. Absence of edema as a consequence of this double operation is proof of restoration of functional activity in the regenerated duct.

- 18a. *Principle of phylogenetical studies on musculature.* E. HUBER, Department of Anatomy, The Johns Hopkins University.

M. Fürbringer ('88) from his famous investigations concluded that the motor nerves may serve as guides to determine muscle homologies. This principle proved successful. Some authors, however, still doubt its unlimited correctness.

Through extensive studies on facial musculature in vertebrates, I became convinced of the fundamental value of Fürbringer's views. A classical example is

the *M. mandibulo-auricularis*: The morphology of this much-disputed muscle was studied. Morphologically and experimentally, the assumed innervation through *R. auriculotemporalis n. trigemini* or through anterior facial branches was disproved. The *R. auricularis posterior n. facialis* was found to be the only motor nerve.

Therefore, the *mandibulo-auricularis* must be an offshoot of the postauricular facial musculature, which is derived from the neck portion of *Platysma*. The primitive organization of this musculature found in some representatives of mammals supports these viewpoints.

With this conception of the morphology of *M. mandibulo-auricularis*, a number of far-reaching phylogenetical conclusions drawn by former authors are proved erroneous. My studies extending over the different groups of mammals revealed the fact that a *mandibulo-auricularis* is missing primarily in monotremes, while it belongs to the general plan of facial musculature of marsupials and placentals.

The nerve supply to the muscle served as a reliable guide in identifying the muscle homologies.

18 b. *Phylogenetical development of facial musculature in vertebrates.* E. HUBER, Department of Anatomy, The Johns Hopkins University.

G. Ruge's classical works afforded the foundation for phylogenetical investigation of facial musculature. To-day we are familiar with the main phases of phylogenesis of this muscle group:

In *Selachii* the most primitive conditions are found. The facial musculature constitutes a small segment of the visceral skeleton musculature, having respiratory function.

In *Amphibia* this muscle segment extends over a larger area and is split into two layers, which remain primitively connected in the nuchal region.

In reptiles the superficial layer has extended over a large part of the neck forming a sphincter colli.

In mammals superficial and deep facial musculatures are separated entirely, but the innervation of both through *N. facialis* proves their common phylogenetical origin. From its original territory in the neck region the superficial layer has extended over the head, giving rise to a large number of mimetic muscles. These are characteristic of mammals only. Monotremes already show high differentiation of this muscle group. The general plan of facial musculature in marsupials and lower placentals is very similar. The morphology of this musculature in the latter group explains the conditions found in higher placentals. Of special interest naturally are the primates. Among these, man shows the highest differentiation of muscles of facial expression. Racial differences can be noticed, the white race having reached the highest degree of differentiation.

18 c. *Genesis of mimetic musculature in mammals and man.* E. HUBER, Department of Anatomy, The Johns Hopkins University.

Comparative anatomical investigations on primates and genetic studies on the numerous variations of mimetic muscles in man form the basis for an understanding of this muscle group which is most complex in man. Primitive connections between individual muscles differentiated out of a common matrix and

the nerve supply of these muscles still reveal phases of their phylogenetical development. To conceive conditions found in primates, extensive studies on Prosimiae and other primitive mammals are necessary to reveal the general ground-plan of mimetic musculature in mammals.

A primitive sphincter colli restricted to the neck gave rise to the sphincter colli profundus, Platysma, and in certain mammals to sphincter colli superficialis. From Platysma developed the retro-auricular musculature and quadratus labii inferioris. The rest of the mimetic muscles were derived from sphincter colli profundus. The whole muscle group is innervated by branches of N. facialis. Experiments have afforded definite evidence against the view that there is a partial supply through cervical nerves, as was assumed by some authors.

The embryological development of facial musculature in mammals and man recapitulates the main phases of phylogenetical development. According to phylogenetical, ontogenetical, and experimental studies, the muscles of facial expression of mammals and man are a uniform phylogenetical muscle group.

19. *The innervation of the female genitalia in the common fowl.* JOHN S. JOHNSON (introduced by Albert Kuntz), Saint Louis University School of Medicine.

The ovary receives its nerve supply directly through the ovarian plexus which contains several small ganglia located in immediate proximity to the ovarian tissue. This plexus is connected by fiber bundles with the coeliac, adrenal, aortic, and superior mesenteric plexuses.

The oviduct is supplied by fibers from the ovarian, left renal, aortic, inferior mesenteric, and hypogastric plexuses. These fibers approach the oviduct in bundles through its suspensory ligament. The cloaca is supplied mainly through the lower sacral and upper coccygeal nerves and the hypogastric plexus.

The intrinsic plexuses in the oviduct are rich in fibers, but contain relatively few nerve cells. Those in the cloaca are rich both in fibers and nerve cells.

20 a. *A source of origin of pigmented leucocytes in amphibia.* H. E. JORDAN, Medical School, University of Virginia.

In recent studies of the blood of frogs, leucocytes with pigment granules were occasionally encountered. Such pigment leucocytes have been previously noted in various amphibia. Their number is small, in the neighborhood of 0.5 per cent of the leucocyte total. Freidsohn ('10) reports 0.7 per cent for adult toad. He found none in young toads and frogs, nor in Triton cristatus and Salamandra maculosa. No attention has yet been given to the matter of a possible correlation between pigmented leucocytes and sex. The origin of the pigment granules of these leucocytes is variously explained. The generally accepted interpretation is that of Prenant ('09), who regards them as hemoglobin derivatives from fragmented erythrocytes. In a comparative study of the normal resorption of the large ova during winter, and their resorption under experimental conditions of abdominal hernia, an extensive source of origin of pigmented leucocytes in females was discovered. During the later stages of yolk resorption the egg mass with its scattered pigment granules becomes invaded by capillaries and connective tissue. Subsequently there appear in these regions large numbers of cells of the character of large lymphocytes. They represent chiefly migratory elements,

possibly in small part local differentiations. These begin to function as monocytes (macrophages), ingesting the free pigment granules, and as pigment leucocytes enter the circulation. Their ultimate fate is largely to disintegrate within the spleen.

20 b. *Yolk resorption under experimental conditions in the frog.* H. E. JORDAN, Medical School, University of Virginia.

Experimental abdominal hernia of ovary in the frog is rapidly repaired by overgrowth of epidermis and invasion of dermal connective tissue. The process of yolk resorption in the herniated ovary is similar to that normally taking place within the abdomen in winter specimens, except for a difference in rapidity. The greater speed of the process in the ovarian hernia is correlated with the appearance of syncytial masses of mesenchymal cells. The smaller eggs are completely resorbed without the intervention generally of giant cells or plasmodia or other indications of striking morphologic change in the enveloping mesenchyme. In the case of the large eggs with much yolk, the enveloping mesenchyme changes into a capsule of several layers of spheroidal cells with lymphocyte features, assuming in certain portions the form of syncytia comparable to multinucleated giant cells. The large oval yolk granules suffer fragmentation. The resulting minute spheroidal fragments are ingested, ultimately digested, by the cells of the enveloping capsules. The constituent cells are of the nature of macrophages or tissue monocytes. Meanwhile the yolk mass of the larger eggs becomes invaded by a delicate connective-tissue reticulum. These data supplement the evidence from other directions, indicating a correlation between giant-cell formation by fusions of mesenchymal cells or their immediate derivatives, and a heightened degree of resorptive activity.

21. *A case of bilateral tubal pregnancy.* H. E. JORDAN and I. A. BIGGER, Medical School, University of Virginia.

Instances of simultaneous pregnancy of both tubes are apparently exceedingly rare. Schreiber (*Z. f. Gyn.*, Oct. 11, 1924), who claims to have reported the first case since that of Borell in 1921, states that only twenty-seven cases are on record. The fact of the rarity of the condition seemed to impose an obligation to study and report this additional case. Our case is very similar to that of Schreiber except that the stage of development is clearly older. Schreiber recovered at operation a normal embryo of the third week from one tube, the ruptured mate containing placental tissue of essentially the same stage of development. In our case the intact left tube contained an apparently normal embryo of 13-mm. length. The stage of development of the chorionic villi in the ruptured mate, together with the menstrual history, indicates that the double tubal pregnancy resulted from a coincident fertilization of two eggs ovulated at approximately the same time. We have no data to base an inference whether or not both eggs came from the same ovary. There is nothing in the clinical history to directly account for the tubal implantation.

22. *The development of the cerebellum in the frog (Hyla regilla).* O. LARSELL,
University of Oregon Medical School.

Detailed evidence is presented of the origin of the cerebellum from a median portion composed of the corpus cerebelli and the eminentia ventralis cerebelli, on the one hand, and the auricular lobe, on the other hand. These two portions fuse across the floor of the recessus lateralis. The lateral part of the definitive cerebellum represents a portion of the floor of the fossa rhomboidea, as shown by stages of development and by the presence of the anterior diverticulum of the lateral recess above this region, in later stages and in the adult.

The molecular and the granular layers of the cerebellum are derived from the stratum album and the stratum griseum of the oblongata, respectively. The nucleus cerebelli and the nucleus vestibularis are genetically related, and in early stages show considerable similarity of connections, which later become modified. The cell pattern of this region is simple. Relatively large cells send dendritic processes laterally which come into relation with several tracts. This condition persists in the adult to some extent in the eminentia ventralis. The fiber-tract connections are similar to those of the adult, with the addition of lateral-line fibers to the auricular lobe, and mamillocerebellar fibers, in the tadpole. These two groups drop out during metamorphosis, and the auricular lobe is relatively reduced in size.

23. *The relative volumes and the arrangement of the cortical and the medullary cells of the suprarenal gland of the chicken.* HOMER B. LATIMER and MILTON F. LANDWER, Department of Zoölogy and Anatomy, University of Nebraska.

Serial sections of six suprarenal glands, from two male and three female single-comb White Leghorns were prepared and the ratios of cortical and medullary, or chromaffin cells were determined. Sectors of every twentieth section were projected onto heavy drawing-paper and the areas representing the two types of cells were cut out and weighed, thus giving the ratios of the cortical and medullary cells. The medullary cells of the two male glands averaged 71 per cent of the cortex. The individual percentages were 65 and 79 per cent. In the females the medulla averaged but 37 per cent of the volume of the cortex, with a range of from 28 to 71 per cent. In three of the female glands the range was from 28 to 34 per cent. This seems to indicate a sex difference in the relative amounts of cortical and medullary cells in the chicken suprarenal.

The two types of cells are intermingled as previously described by others, but the cortical cells are grouped in larger masses toward the periphery, resembling a zona glomerulosa, with smaller sinusoids, while in the central portion the masses of cortical cells, especially, are much smaller. More material would be necessary for final conclusions for both of these points.

24. *A determination of the polyhedral form of human fat-cells.* FREDERIC T. LEWIS, Harvard Medical School.

Whether fat-cells are dodecahedral, tetrakaidecahedral, or of indeterminate form is the question at issue. Developing independently of one another and subsequently coming into contact, with mutual compression, and being filled with oil instead of thinner fluids, they differ much from the cells of vegetable parenchyma. Yet in both cases the cell form proves to be primarily or typically

tetrakaidecahedral. From serial sections it is found that, in 100 fat-cells studied, the number of contacts of a cell with its neighbors varies from nine to twenty, with an average of 14.01. Estimated from wax models of ten of them, their volume ranges from 0.000024 to 0.00095 cu.mm., with an average of 0.00045 cu.mm. Thus the volume of these fat-droplets is closely one-half that of the cells of elder pith. In form, the fat-cells are more nearly isodiametric, but in their contacts with their neighbors they are much more irregular. Many of the quadrilateral and hexagonal facets of the typical tetrakaidecahedron are replaced by pentagons, which, in the ten fat-cells modeled, constitute the prevailing form. Instead of presenting 60 quadrilateral and 80 hexagonal surfaces, the ten cells modeled show 2 triangular, 30 quadrilateral, 74 pentagonal, 33 hexagonal, and 2 heptagonal surfaces. A full and illustrated report will be published in the current volume of the Proceedings of the American Academy.

25. *The resemblance between the Kupffer cells and the mononuclear leucocyte of the frog studied in vitro.* MARGARET R. LEWIS, Department of Embryology, Carnegie Institution of Washington.

In order to observe the Kupffer cells side by side with the leucocytes, a small piece of liver was teased in a hanging drop of blood taken from the heart of the same frog. At first the Kupffer cells were readily distinguished from the leucocytes, as they were much larger and contained partially digested red blood-cells and some melanin granules. In the hanging-drop preparations the Kupffer cell lost part of its foreign material, while the mononuclear leucocyte took in foreign bodies, became greatly hypertrophied, and the nucleus lost its typical leucocytic appearance. Both the Kupffer cell and the mononuclear cell frequently had a small centrosphere, but in other instances cells of both types contained so much ingested material that the centrosphere was obscured. After two or three days, the two types of cells had become in many instances almost identical. The Kupffer cell did not become a mononuclear leucocyte; neither could one say that the mononuclear leucocyte became a Kupffer cell, but in their transformed state they were practically identical.

26. *Origin of the phagocytic cells of the lung of the frog.* MARGARET R. LEWIS, Mount Desert Island Biological Laboratory and the Department of Embryology, Carnegie Institution of Washington.

Since the lung of the amphibian is transparent and can be distended outside of the body wall, it furnished a method for the study of the ingestion of carbon particles and the formation of phagocytic cells in vivo. The carbon, as it came in contact with the blood, began to agglutinate, so that there were formed much larger particles, as well as threads of different sizes, which stuck to the white blood-cells and occasionally to the endothelial cells. After the carbon had become attached to a leucocyte, the latter no longer traveled swiftly with the blood stream, but lingered along the wall of the blood vessel. Often several blood cells, with some carbon particles, became massed together; in other instances the larger carbon particles stuck together and formed emboli. These emboli usually became surrounded by leucocytes. Within a few minutes after the carbon had been injected into the heart, none of it was to be seen in the blood stream. Neither the epithelial cells nor the endothelial cells formed into

macrophages, but within an hour after the carbon had been introduced many large mononuclear cells containing carbon were lodged in the endothelial walls. These cells later hypertrophied and became typical elasmatoocyte-like macrophages. Ligaturing the liver and spleen did not decrease the number of macrophages found in the lungs. The same type of macrophages developed in hanging drops of blood to which a minute amount of carbon had been added.

27. *Monocytes, macrophages, epithelioid cells, and giant cells.* MARGARET R. LEWIS and WARREN H. LEWIS, Mount Desert Island Biological Laboratory and the Department of Embryology, Carnegie Institution of Washington.

In hanging-drop cultures of pure blood from elasmobranchs, teleosts, amphibia, reptiles, birds, mammals, and man the large mononuclear cells or monocytes undergo marked changes in the course of a few days. They ingest and digest debris, dead white blood cells, and red blood cells, accumulate fat-globules, and hypertrophy. The partly digested materials and the vacuoles which may later surround them have a marked affinity for vital dyes. Such cells are not to be distinguished from macrophages or elasmatoocytes. Some of the monocytes ingest finer material which accumulates about the centrosome and forms a large central area readily stainable with vital dyes. The central area usually becomes surrounded by an intermediate zone of fat-globules, among which lie the mitochondria. Such cells show more or less hypertrophy and are precisely similar to the epithelioid cells of tuberculous lesions. Many intermediate forms between macrophages and epithelioid cells arise. Some of the epithelioid cells hypertrophy and form giant cells with two to fifty nuclei, exactly similar to those found in tuberculous lesions. Monocytes, macrophages, epithelioid cells, and giant cells represent merely functional states of the same cell type. Their differences depend in part on the amount, character, and condition of the ingested and partly digested material.

28. *Cell inclusions, vital dyes, and the so-called 'segregation apparatus.'* WARREN H. LEWIS, Carnegie Laboratory of Embryology, Baltimore, Maryland.

Ingested materials are never taken into preexisting vacuoles, but always pass directly into the cytoplasm in the various body cells studied in tissue cultures. After ingestion, particles of various sizes may become clumped through the action of cytoplasmic currents, vacuoles may later develop about ingested material, but digestion may take place without their formation. Vacuoles and granules may also arise from injury and breaking down of the cytoplasm. The vacuoles, granules, and partly digested materials that take up such vital dyes as neutral red are all cytoplasmic inclusions and do not constitute a 'segregation apparatus.' Cells do not possess such an apparatus. Vital dyes stain only preexisting cell inclusions, and not the living protoplasm. Many normal cells are without such inclusions and do not stain with the dyes. Some dyes are clotted or precipitated under certain conditions outside the cell and ingested as fine dye granules that later may be clumped within the cell, like other types of ingested material.

29. *The trapezius muscle of the ganoid fishes.* H. W. NORRIS, Department of Zoölogy, Grinnell College.

There has been much uncertainty as to the occurrence of a trapezius muscle in the ganoids: wholly absent (Gegenbaur); absent in *Acipenser* (Vetter, Theunissen); present in embryo *Acipenser*, absent in adult (Edgeworth, van der Horst); absent in *Amia* (Theunissen); small muscle in *Amia* and *Lepidosteus* (Black); derivative of the levator muscle of the last branchial arch in *Amia*, *Lepidosteus*, *Polypterus* and *Acipenser* (Allis, Edgeworth); present in *Polyodon* (Danforth). Innervation, whenever traced, from the vagus nerve.

Two distinct muscles have caused confusion—a levator of the fifth branchial arch and a true trapezius; both present in *Amia* (and probably in *Polypterus*, Allis), but the trapezius vestigial with origin on trunk muscle fascia and insertion on the dorsal tip of the cleithrum. In *Lepidosteus* a functional trapezius in the same relative position as the vestigial one in *Amia*. (In *Polyodon*, *Scaphirhynchus*, and *Acipenser* (Goronowitsch) the trapezius is functional and is innervated by a branch of the ramus lateralis vagi that enters the latter from the vagus proper near the vagus ganglion.

Conclusion: the trapezius is present in all ganoids, but vestigial in *Amia* and *Polypterus*.

30 a. *A locospinal tract.* JAMES W. PAPEZ, Cornell University Medical School, Ithaca.

In the human brain a large myelinated tract has been identified that arises from the caudolateral side of the nucleus locus coeruleus (sometimes from the caudomedial side). It descends through the pons and medulla to reach the cord. When it takes a dorsal course, it is seen as a definite white bundle in the ventricular floor associated with the acoustic stria, most frequently on the left side. From the locus it extends over the vestibular nuclei and nucleus intercalatus and decussates along the median raphe between the cephalic ends of the hypoglossal nuclei. Here it enters the reticular formation and is lost in the lower end of the medulla. It may contribute fibers to the intercalate and hypoglossal nuclei. More often it takes a deep course and is lost in the reticular formation ventral to the vestibular nuclei. The tract is not identical with Probst's tract to the salivatory nuclei nor with one of the acoustic striae. Its affinity to Pick's bundle is uncertain.

30 b. *Location of salivatory nucleus for chorda tympani in man.* JAMES W. PAPEZ, Cornell University Medical College, Ithaca.

In a case of labyrinthine tuberculosis a firm tubercular tumor had completely destroyed all nerves in the internal acoustic meatus. The medulla and pons were sectioned serially and stained by the Nissl method for chromatolytic changes. The series reveals the following:

1. A high-grade chromatolysis of the entire right facial nucleus and of the small accessory group of cells between the oral end of the facial and the abducens nucleus.

2. A severe degeneration of a considerable group of cells in the dorsolateral reticular formation between the pars prima of the facial nerve and the dorsal

limits of the trigeminal nucleus. This corresponds in position to Yagita's salivatory nucleus that contributes fibers to the chorda tympani in the dog.

3. A marked degeneration of cells in the inferior reticular nuclei of Van Hoeverl ('11) on both sides. This extensive constellation of large cells is located in the reticular formation in the upper medulla on each side of the raphé, dorsal to the upper third of the inferior olive, orally to the level of the facial nucleus. It is too caudal to correspond to the 'nucleus salivatorius' of Kohnstamm ('02) in the dog. Marchi sections at lower end of medulla show no degenerated fibers entering the cord. The interpretation is that this nucleus contributes crossed and uncrossed fibers into the facial nerve. Their destination is unknown.

31. Spinal root of trigeminus. JAMES W. PAPEZ and ETHEL SIMPSON, Cornell University Medical College, Ithaca.

In previous experiments on the trigeminus in cats it appeared that trigeminal impulses escaped into the cord even when the spinal root of the trigeminus was severed, so that sneezing and head retraction were elicited by contacts in the nostril on the side of the lesion.

To prove this, trigeminal responses were tested in five cats for several weeks. Then the left trigeminal root was cut where it entered the cord. The animals lost sensibility and reflex responses over the lower lip and ear, along a zone bordering the upper cervical nerves. All other trigeminofacial and trigemino-spinal response remained intact, e.g., blinking, bulbar and head retraction, sneezing, lip, whisker, tongue, and jaw movements. After fourteen days, Marchi method.

Conclusions: The trigeminal root in the cord contains fibers of the mental and auricular branches of the nerve. It does not serve as the afferent arm for the responses of sneezing, head retraction, and tongue movements. These reflexes must be mediated by some other connections. It has reflex connections with cell groups of the facial nucleus that innervate the posterior, auricular, and inferior labial muscles. Its significance is segmental as indicated in man in cases of progressive bulbar palsies.

32. Atresia of the bony anterior nares. H. J. PRENTISS, Department of Anatomy, University of Iowa.

An adult negress, history unknown. Presents a bony atresia of the anterior nares. Possibly the epithelial plug, which closes the region in the early stages, formed a bridge for mesodermal invasion. Exhibit of specimen and four photographs.

33. The notches and fissures of the human spleen. M. C. PUGSLEY (introduced by A. T. Kerr), Cornell University Medical College, Ithaca.

To determine the cause of the notches on the borders and the fissures on the parietal surface of the human spleen, 114 specimens were studied. Ninety per cent were notched on the ventral border, 50 per cent on the dorsal border, 28 per cent on the intermediate border. One-third contained fissures on the parietal surface.

Of the notches on the ventral border, 6 per cent had peritoneal ligaments entering them, 8 per cent had vessels entering them, but by far the greater number—86 per cent corresponded to neither vessels nor ligaments. No notches on the dorsal border had any relation to vessels or ligaments. Ninety-six per cent of the notches on the intermediate border were just below the tubercle which was found on the cephalic end of this border in 66 per cent of cases. Sixty-eight per cent of all fissures were continuous with ventral or dorsal notches.

Notches and fissures in human, cat, and dog spleens were photographed and serial sections made. In a considerable number of instances a large connective-tissue trabecula extended from the depth of the notch or fissure toward the hilus of the spleen.

An examination of spleens in human and animal embryos is now being made to determine if the fissures and notches in the embryos are always associated with trabeculae, and to explain those cases where no trabeculae are associated with the notches in the adult.

34. *The relative number of the different types of cells in pars anterior of the normal adult male hypophysis of man.* A. T. RASMUSSEN, Department of Anatomy, Medical School, University of Minnesota.

This study is based on serial sections of thirty glands from cases of accidental and sudden death in which autopsy was performed within twelve hours after death and in which there was no significant pathology. The sections, 5μ in thickness, were stained with Mallory's aniline blue-orange G mixture and acid fuchsin. In each case the nucleated cells in 100 to 200 microscopical fields from different parts of the gland were divided into chromophobes (chief cells), acidophiles, and basophiles.

Chromophobes are without exception the most numerous, varying from 37 per cent to 65 per cent, the average being 57 per cent. Acidophiles are next, varying from 23 per cent to 43 per cent, with an average of 31 per cent. Basophiles are without exception the least numerous, varying from 5 per cent to 27 per cent, the average being 12 per cent.

The variability in these carefully selected normal cases is great enough to render questionable the validity of many of the changes in the hypophysis which have been reported in connection with some physiological and many pathological conditions.

After forty-five to fifty years of age, there is apparently less variability with a noticeable increase in the percentage of chromophobes. In the nineteen cases under fifty years, the average percentage of chromophobes was 55.6, while in the eleven cases over fifty years the chromophobes represented 59.2 per cent.

35. *Quantitative study of the hypophysis cerebri of the guinea-pig in experimental scurvy.* EVERETT K. ROWLES (introduced by A. T. Rasmussen), Department of Anatomy, Medical School, University of Minnesota.

A scorbutic diet produces apparently no marked changes in absolute weight of the whole hypophysis in the guinea-pig; although, since the body weight decreases it apparently shows an increase. The gross weight of the hypophysis after animal has been fed on a scurvy diet continues to increase as if the animal were

on a normal diet. Ten days after beginning of scurvy symptoms, pars anterior shows a slightly large percentage of the whole hypophysis and pars intermedia and pars posterior show a corresponding smaller percentage. In the final stage of scurvy, however, there is a decided increase in percentage weight of pars anterior, and a corresponding decrease in percentage weight of pars intermedia and posterior.

A volumetric analysis of the blood areas of pars anterior, both on the hypophysis of the control animals and those in different stages of experimental scurvy, shows an increase of blood to 50 per cent of its volume ten days after beginning of scurvy symptoms. In the final stages of scurvy there is an increase of 376 per cent.

The apparent normal growth in the hypophysis during scurvy is due, therefore, to congestion in pars anterior, and not to growth in the essential parenchyma. In fact, there is an actual decrease in parenchyma, as shown by distinct karyorexis and karyolysis in later stages.

36. *The normal weight of the adult human pancreas.* JOHN H. SCHAEFER (introduced by R. E. Scammon), Laboratories of the Mayo Foundation for Medical Education and Research and the Department of Anatomy, University of Minnesota).

A quantitative study has been made of the weight of the pancreas in a series of individuals of twenty-one years and over in age. The material consisted of the published records of Boyd, Clendinning, Porter, Conroy, and Assman, and 210 cases collected by the author at autopsies at the Mayo Clinic.

A statistical study of this material gives the following results: The provisional normal weight for the male pancreas is 91.64 grams, with a standard deviation of 23.09 grams and a coefficient of variation of 25.10 per cent. The provisional normal weight for the female pancreas is 85.42 grams, with a standard deviation of 22.05 grams and a coefficient of variation of 25.81 per cent.

Fatty pancreases are both heavier and more variable than normal ones.

There is a small definite positive correlation between pancreas weight and body weight, in maturity, in both males and females.

There is apparently a significant negative correlation between pancreas weight and age in the female, but this has not been found in the male.

There is apparently a low positive correlation between pancreas weight and body weight in the male, but this correlation was not found in the female.

A more extended report of this study, including a detailed tabulation of results, will be published in the near future.

37. *A quantitative study of the growth of the crypts and glands of the human stomach.* GORDON H. SCOTT (introduced by Richard E. Scammon), Department of Anatomy, University of Minnesota.

The average number of gastric crypts per square millimeter was determined for thirty-four individuals, from nine fetal months to forty-four years in age. Each average represents counts of fifty areas from each stomach. These averages are: ninth fetal month, 33.04; tenth fetal month, 43.19; birth, 50.24; two months, 50.18; seventh month, 53.93; twenty-one months, 66.27; fourth year, 66.24; seventh year, 65.60; fifteen years, 61.98; maturity, 61.87.

The average number of gastric glands per square millimeter was determined for the thirty-four individuals. Each average represents counts of fifty areas from each stomach. These averages are: ninth fetal month, 79.65; tenth fetal month, 104.52; birth, 121.36; two months, 128.28; seventh month, 181.31; twenty-one months, 389.29; fourth year, 385.28; seventh year, 390.72; fifteen years, 272.64; maturity, 266.59.

The mucosal area was determined for each stomach. Areas in square centimeters: ninth fetal month, 28.93; birth, 40.81; two months, 163.87; twenty-one months, 203.97; seventh year, 258.16; maturity, 553.54. Normal differences in mucosal area do not effect the number of crypts and glands per square millimeter.

The estimated total number of crypts at birth is 204,625; at maturity, 3,423,572; total increase, 15.66 times. The estimated total number of glands at birth is 489,432; at maturity, 14,774,481; total increase, 28.04 times.

38. Effect of different hydrogen-ion concentrations on mitochondria in the liver cell. J. T. SCOTT (introduced by Ivan E. Wallin), University of Colorado School of Medicine.

Various investigators have produced changes in size, shape, and number of mitochondria by ligation, starvation, vitamin deficiency, poisons, gases, etc. Structures grown in artificial culture media and thought to be of mitochondrial origin have been made to respond to changes in hydrogen-ion concentration (Wallin, '24). It was suggested that changes produced in vivo might be due in part to changes in hydrogen-ion concentration and that responses obtained in artificial culture media might also be produced in tissues after incubation in fluids of various hydrogen-ion concentrations.

Small bits of rabbit's liver were incubated at 37.5°C. in physiological salt solution with hydrogen-ion concentrations ranging from pH 4.4 to pH 9.0 for various periods of time. The tissues were then fixed in bichromate-osmic solution and stained for mitochondria. Microscopic examination revealed the following results:

1. Mitochondria in the liver cell can be stained at the periphery of the block after four hours' incubation in physiological salt solution.
2. The mitochondria are best preserved as indicated by staining, when the solution has a pH value between 7.5 and 8.0.
3. After incubation, a greater variation from the normal in size and staining reaction is noted.
4. After incubation in slightly alkaline solutions, a decrease in number is apparent, while an increase in size is evident—some granules being as much as twice the diameter of the normal.

39. Further evidence upon the differential response of the melanophore stimulant and the oxytocic and blood-pressure autocoid of the pituitary to destructive agents. PHILIP E. SMITH, Department of Anatomy, University of California.

Ten samples of posterior lobe of the bovine hypophysis whose pH ranged from 3.11 to 13.05 and four samples of the anterior lobe with a pH of 3.58 to 13.0 were autoclaved at 15 pounds for one hour. All the samples so treated gave a pronounced pigmentary response when injected into the hypophysectomized tadpole.

The fact that the pigmentary principle will withstand treatments which have been shown to destroy the blood-pressure, smooth-muscle, and respiratory principle points to its being a separate autocoid. This is further supported by the fact that a pigmentary response is given by injections of anterior-lobe substance unpolluted by posterior lobe, while no smooth-muscle effects result from injections of this substance.

40. *The structure of adult human articular cartilages.* HARRY A. SOMMERFIELD (introduced by A. W. Meyer), Stanford Medical School.

Articular cartilages really should be classed as hyaline, fibrohyaline, and fibrocartilages. Most hyaline articular cartilages have a fibrohyaline periphery, others are fibrohyaline throughout considerable portions and some as that on the mandibular condyle and the articular eminence are composed of a deeper purely hyaline and a superimposed purely fibrous layer. The former disappears gradually with increasing age. In advanced age both these layers may be replaced by an exceedingly thin layer of dense fibrous tissue which appears as though it had undergone hyaline transformation. The Trennungstreifen varies greatly in conspicuousness and an intermediate densely nucleated fibrous zone is present in the mandibular condylar cartilage.

Even at the age of eighteen years, marrow, fat-cells, and vascular fibrous extensions are separated from the articular cartilages by endochondrium only in numerous places, and portions of hyaline cartilage and smaller portions of the same are found far beneath the chondro-osseous junction in the trabeculae of the spongiosa.

Some individual and age as well as regional differences were found to exist in the structure of the articular cartilages, and some of the facts ascertained do not harmonize very well with statements in current text-books of gross and microscopic anatomy.

41. *Leucocytic reaction to acute inanition.* M. H. STREICHER and V. E. EMMEL, University of Illinois, College of Medicine.

The following data were obtained on the reaction of leucocytes in a series of albino rats during a period of 132 hours' inanition, successive tests being made every 24 hours. The average total leucocyte count of 10,901 at 12 hours of inanition gradually decreased to 5800 at 108 hours, giving a percentage decrease of 46.7. At 132 hours this percentage difference was reduced to 31. The small lymphocytes gave a percentage increase of 5.6 at 36 hours, and then progressively decreased to 63 per cent below the initial count at 108 hours and 55 per cent at 132 hours. Up to 108 hours the large lymphocytes gradually declined to a percentage decrease of 74. At 132 hours the percentage decrease was only 58. At 36 hours the neutrophiles gave a decrease of 48 per cent, and then gradually increased to 44 per cent above the initial count at 132 hours. The data indicate a tendency for an increased absolute rise in neutrophiles and a temporary relative increase in lymphocytes at approximately the 132-hour period.

The Arneith picture for neutrophiles is definitely displaced to the right, with a predominance of the segmented-nucleate elements. The eosinophiles apparently indicated no significant reaction. The azurophile granulation in lymphoid cells gradually decreased from an initial 32 per cent at 12 hours to 3 per cent at 132 hours—a confirmation of previous results (Emmel, *Anat. Rec.*, vol. 23, p. 16).

42. *The rôle of the thyroid in the neoteny of the Mexican axolotl.* E. UHLENHUTH, Department of Anatomy, Johns Hopkins Medical School.

In September, 1923, twenty-one larvae of the eastern *Amblystoma tigrinum*, a species metamorphosing in a normal way, but believed to be either the same species as the neotenuous axolotl or closely related to the axolotl, were thyroidectomized at an age of approximately 160 days, at which time they measured from 81 to 112 mm. total length. Those deprived of the thyroid while in the course of the first skin shedding died from a few hours to a few days after operation. Of the nine larvae thyroidectomized totally, three are still alive at an age of twenty-one months. The largest measures 215 mm. Although they are completely larval and are sex-mature (male), they are essentially different from the Mexican axolotl. In particular they are of slender build, the skin is thin, the legs strong, the eyes are large and slightly bulging. The pigmentation of the skin is a light olive-green with brownish-black spots. The animals still show a peculiar tendency to becoming conspicuously pale when kept in darkness. Except for the latter property, they resemble the North Dakotan axolotl.

Removal of the thyroid from the larvae of *A. tigrinum* of from 81 to 112 mm. total length does not result in a change from eastern larval type into the type of the neotenuous Mexican axolotl.

43. *Comparative hormonal efficiency of embryonic thyroid.* E. UHLENHUTH and A. EBELING, Rockefeller Institute for Medical Research.

In order to determine if embryonic thyroid elaborates and contains the specific thyroid hormone, thyroids of chicken embryos of eighteen days' incubation were fed to the larvae of the salamander, *Amblystoma tigrinum*. The acceleration of metamorphosis was used as an indicator of hormonal efficiency of the thyroid. The thyroid feeding started when the larvae were about twenty-four days old. The normal control larvae metamorphosed at an age of eighty-two days and later. Other controls fed adult chicken thyroid metamorphosed at an age of from fifty-two to fifty-three days after having received each from twenty to twenty-seven pieces of adult chicken thyroid (each piece of the size of one lobe of embryonic thyroid). Of the larvae fed embryonic thyroid one metamorphosed at an age of sixty-two days, after having received eighty-five lobes of embryonic thyroid; one metamorphosed at an age of seventy-two days after having received 104 lobes of embryonic thyroid; two larvae, having received ten and fifteen lobes, showed no acceleration of metamorphosis.

The thyroid of chicken embryos of eighteen days' incubation does contain the specific thyroid hormone, but only about one-fourth to one-fifth of the amount contained in an equal mass of adult chicken thyroid.

- 44 a. *Histological changes in the male rat hypophysis following degeneration of the germinal epithelium.* GERTRUDE VAN WAGENEN (introduced by H. M. Evans), Department of Anatomy, University of California.

Ligation of the ductuli efferenti is followed within twenty-one days by a degeneration of the germinal epithelium. Examination of the hypophysis eight weeks later shows an increase in the number and the size of the cells containing basophilic granules. These cells have the appearance of the 'castration cell.'

It has also been possible to examine the hypophysis of male rats in this laboratory in which profound degeneration of germinal epithelium had been brought about by a dietary deficiency—that of vitamine X. Here, also, the hypophyseal picture was that described above and comparable to an early gonadectomy hypophysis.

44 b. Changes in the testis of the rat following ligation of the ductuli efferenti.

GERTRUDE VAN WAGENEN (introduced by H. M. Evans), Department of Anatomy, University of California.

Twenty-one days after ligation, the rat testis has become transparent and has decreased in volume 30 to 50 per cent. Histologically, the germinal epithelium is degenerated, but the intertubular tissue shows no degenerative changes.

A series of unilaterally operated animals was prepared. Palpation twenty-four hours after operation showed the ligated glands to be very hard. This turgidity reached a peak between twenty-four and thirty-six hours. At forty-eight hours there was a marked decrease, and at seventy-two hours the ligated and the unligated glands responded alike. However, the ligated glands became smaller and softer. An instrument was devised to measure this changing turgidity and confirmed the above results.

Histological study gave a clew to the origin of the pressure. Twenty-four-hour glands showed an increase in the lumen and diameter of each tubule. Forty-eight-hour glands showed evidence of degeneration of germinal epithelium as a result of this increased pressure of intratubular origin. It seems probable, at this time, that the resistance of the fibrous tunica albuginea to the increase in internal pressure causes blood stasis in the gland for a period of about twenty-four hours, which period of malnutrition and oxygen want is sufficient to injure the sensitive germinal epithelium.

45. On the nature of mitochondria. IX. Demonstration of the bacterial nature of mitochondria. IVAN E. WALLIN, University of Colorado Medical School.

Liver tissues from foetal, newborn, three-weeks-old, and adult rabbits was incubated in special media containing tryptophane or urea. After short periods of incubation (two to twenty-four hours), the tissues were removed, fixed, sectioned, and stained. On microscopical examination, the degenerating liver cells were found to contain pleomorphic mitochondria which are identical in morphology to the surface bacterial upgrowths that have been obtained constantly in the previous mitochondrial culture experiments. These experiments, together with the previous culture experiments, appear to demonstrate conclusively that mitochondria are bacterial organisms.

46. The oestrous cycle in the rabbit. GEORGE J. WOOD (introduced by H. M. Evans), Department of Anatomy, University of California.

Observations have been made on healthy young female rabbits of the New Zealand Red strain. Changes in the cell content of the vestibulum and of the vagina show a typical oestrous cycle which is approximately ten to thirteen days in length or, in its extremes, from nine to fifteen days. On the approach of oestrus there is a sudden diminution of the polymorphonuclear leucocytes and

the appearance of myriads of epithelial cells, both of the squamous and columnar types. About twelve hours later, cornified cells occur mixed with the various epithelial cells. The cells are frequently in sheets. The cornified cells can be obtained for a period of twenty-four hours. Leucocytes then come in in great numbers, eosinophiles being particularly abundant. The final, or resting, stage is that in which leucocytes occur in smaller numbers admixed with the various other epithelial cell types. During stages I and II the vaginal canal contains an abundance of fluid, at first quite mucous in character, and this is also the case with the uterus—a phenomenon resembling that shown by Stockard and Papanicolaou for the guinea-pig.

DEMONSTRATIONS

1. a) *Microscopic sections of cataractous eyes of albino rats.* b) *Human jejunum, from case of poisoning, due to swallowing formaldehyde solution.* W. H. F. ADDISON, University of Pennsylvania Medical School.
2. *Papillae on the inner surface of the lips in the cat.* (Gross preparations, photographs, and sections.) BARRY J. ANSON (introduced by F. T. Lewis), Harvard Medical School.

These structures, comparable with the transient villi of the human lip and with the coarse elevations permanent in ruminants (cf. F. E. ESchulze's studies), were described in *Science*, December 5, 1924; their distribution among mammals and possible interpretation as abortive selachian denticles are under investigation.

3. *The process of bone repair.* T. H. BAST, W. E. SULLIVAN, and F. D. GEIST, Department of Anatomy, University of Wisconsin.
4. a) *Typical interprocess ligaments and their action.* b) *A well-developed tunica abdominalis in man.* O. V. BATSON, Department of Anatomy, University of Cincinnati.
5. *Charts of organ weights to illustrate a four-dimensional table for expressing the array of four factors.* R. BENNETT BEAN, Anatomical Laboratory, University of Virginia.
6. *An accessory patella.* BRACK M. BOWMAN (introduced by O. V. BATSON), Department of Anatomy, University of Cincinnati.
7. *Wax models of embryonic and adult gall bladders.* EDWARD A. BOYDEN, Harvard Medical School.
8. *Development of the nasal cavity in the striped ground-squirrel (Spermophilus citellus tridecemlineatus).* B. I. BURNS (introduced by H. J. Prentiss), Department of Anatomy, University of Iowa.
9. *Photographs illustrating the anatomical literature of the earlier Middle Ages, 1100-1225 A.D.* GEORGE W. CORNER, University of Rochester.
10. *An introduction to the finer anatomy of the central nervous system based upon that of the albino rat.* E. HORNE CRAIGIE, Department of Biology, University of Toronto.
11. a) *Scapular types.* b) *Scapular age changes.* WILLIAM W. GRAVES, Saint Louis, Missouri.
12. *A case of true hermaphroditism in the pig, with unilateral ovo-testis.* ALAN F. GUTTMACHER, University of Rochester.

13. *The absorption of anisotropic lipoids by the mucous membrane of the gall bladder.* BELA HALPERT (introduced by L. H. Weed), Johns Hopkins University.
14. *Vital staining of the chick embryo by injecting the dye into the air sac of the incubating egg, as shown by microscopic sections, preserved specimens, and living chicks.* E. B. HANAN (introduced by Wayne J. Atwell), University of Buffalo.
15. *A device for orthographic projection.* ALBERT J. HERBELSHEIMER (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.

This apparatus was devised for the purpose of orthoscopic reconstruction. It consists essentially of a steel rod bearing near its midpoint, a cross-hair reading tube and, at the right-hand extremity, a spring-controlled prick punch. The whole is so mounted as to be freely movable over the two dimensions of a horizontal plane.

The advantages of the instrument lie in the fact that readings can be taken rapidly, and that the gaze is not shifted from the object in making the plotting. The loci are plotted while the cross hairs are in position so that the possible source of error in transferring the readings to paper is eliminated.

16. *Specimens and photographs of rats treated with acetyl thyroxin.* MARGARET M. HOSKINS, University of Arkansas, Medical School.
17. *Preparations illustrating the development of the temporary sexual characters of *Diemyctylus* in relation to histological changes within the testis.* R. R. HUMPHREY, School of Medicine, University of Buffalo.
18. *Some aspects of bone variability.* N. WILLIAM INGALLS, Western Reserve University. (This will be found on balcony of anatomical museum.)
19. *Microscopical preparations of human lymph nodes, showing local development of erythrocytes.* H. E. JORDAN and H. T. MARSHALL, Medical School, University of Virginia.
20. *Sections of embryos showing cells of medullary origin in ventral nerve roots and the primordia of sympathetic ganglia in the absence of spinal ganglia and dorsal nerve roots.* ALBERT KUNTZ, Saint Louis University, School of Medicine.
21. *A series of diagrams illustrating the development of the inferior vena cava in man.* CHARLES F. W. MCCLURE and ELMER G. BUTLER, Princeton University.
22. *Stages in normal and abnormal human development.* W. H. MCGAW and R. A. TRENKLE (introduced by N. William Ingalls), Western Reserve University.
23. a) *Behavior of blood leukocytes in tissue culture.* b) *Behavior of endothelium of blood vessels in tissue culture.* ALEXANDER A. MAXIMOW, University of Chicago.
24. *Graphs showing changes in size of cells and nuclei of liver cells from albino rats submitted to inanition.* SHIRLEY P. MILLER, Department of Anatomy, University of Minnesota.
25. *A practical iron-alum haematoxylin method for staining fiber tracts in the human brain.* L. O. MORGAN (introduced by James W. Papez), Department of Anatomy, Cornell University Medical College, Ithaca.
26. *Preparations of the placenta of the rabbit to show that the direction of the flow of blood in the foetal capillaries is opposite to that in the trophoblastic tubules.* H. W. MOSSMAN (introduced by Charles R. Bardeen), University of Wisconsin.

27. *Graphic and wax-plate reconstructions from chick and pig embryos of corresponding developmental stages.* BRADLEY M. PATTEN, Laboratory of Histology and Embryology, Western Reserve University.
28. *Orthoscopic reconstruction plottings of the head and neck reduced to the same area to show the developmental topography of the brain and cranial nerves.* W. T. PEYTON (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.
29. *Ferrata's so-called 'hemohistioblasts' and their multiple origin.* ADOLPH R. RINGOEN, Department of Animal Biology, University of Minnesota.
30. *Charts and graphs illustrating the quantitative growth of the skeletal musculature and skeleton of the human fetus.* HAROLD ROE (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.
31. *A new method for the microscopic study of living growing tissues by the introduction of a transparent chamber in the rabbit's ear.* J. CALVIN SANDISON (introduced by E. R. Clark), Medical Department, University of Georgia.
32. *Curves and graphs illustrating the comparative accuracy of the determination of the crown-heel and crown-rump length in the fetus and newborn. Curves illustrating the various expressions for the expression of the relation between crown-rump and crown-heel length in prenatal life.* RICHARD E. SCAMMON and LEROY A. CALKINS, Department of Anatomy, University of Minnesota.
33. *Models and drawings of specimens illustrating the development of the hip, knee, ankle, and elbow joints in the fetus, newborn infant, and child.* RICHARD E. SCAMMON, Department of Anatomy, University of Minnesota.
34. *Curve and field graphs illustrating the growth in height and weight of tuberculous and suspected tuberculous school children.* RICHARD E. SCAMMON and C. K. PETTER, Department of Anatomy, University of Minnesota, and the Lymanhurst Hospital, Minneapolis, Minnesota.
35. *Material illustrating the growth of the human gastric mucosa, gastric crypts, and gastric glands in prenatal and postnatal life.* GORDON H. SCOTT (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.
36. *Preparations bearing on the position of the mesoderm of *Amblystoma punctatum* before gastrulation.* H. D. SENIOR, University and Bellevue Hospital Medical College.
37. *The collection and preparation of long series of skeletons.* T. WINGATE TODD, Western Reserve University.
38. *Human exfoliated epidermis—surface preparations one cell in thickness.* B. B. VARIAN (introduced by W. H. F. Addison), University of Pennsylvania Medical School.
39. *Charts, graphs, and sections illustrating the quantitative growth of the arterial system of the human fetus.* C. H. WATKINS (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.
40. *The regeneration of the gustatory apparatus in the rat.* BEATRICE WHITESIDE, Washington University, Saint Louis.
41. *Non-bifurcating pain fibers of the trigeminal nerve.* W. F. WINDLE, Northwestern University Medical School.

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